

**MALCOLM
PIRNIE**



ARCS II

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Contract No. 68-W9-0051

**LI TUNGSTEN
GLEN COVE, NEW YORK**

Work Assignment No. 025-2L4L

**REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN
PART I OF II**

**Remedial Planning Activities at Selected
Uncontrolled Hazardous Substance Disposal Sites
USEPA Region II (NY, NJ, PR, VI)**

**Malcolm Pirnie, Inc.
2 Corporate Park Drive
White Plains, New York 10602**

March 1993

**WORK PLAN
REMEDIAL INVESTIGATION/FEASIBILITY STUDY**

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**MALCOLM PIRNIE, INC.
2 Corporate Park Drive
White Plains, New York 10602**

ARCS II CONTRACT NO. 68-W9-0051

WORK ASSIGNMENT # 025-2L4L

SITE NAME: LI LUNGSTEN
RI/FS WORK PLAN
MARCH 1993

CONTRACTOR QA/QC SIGN-OFF

Malcolm Pirnie, Inc. has reviewed this draft document in accordance with the contractor's ARCS II QAPP and is submitting it to USEPA, Region II in compliance with the requirements under Work Assignment No. 025-2L4L and Contract No. 68-W9-0051.

This document has not been approved by USEPA Region II and is not intended for release to the public.


Dennis G. McGrath
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Date: 15 March 1993


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Date: March 19, 1993

**LI TUNGSTEN SITE
GLEN COVE, NEW YORK
WORK ASSIGNMENT #025-2LAL**

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LI TUNGSTEN RI/FS WORK PLAN

EXECUTIVE SUMMARY

SITE LOCATION AND BACKGROUND

The Li Tungsten site is located at 63 Herb Hill Road in the City of Glen Cove, Nassau County, Long Island, New York. This site has a complex history of name and ownership changes, and environmental site assessments, investigations and removal actions. Specific details are discussed in Section 2.0. From early 1940's until approximately 1985, tungsten ores or concentrates, imported primarily from mainland China, South America and Canada, were smelted at this facility for the production of tungsten carbide powder, tungsten wire, and welding rods (NUS, 1989; 1990). In 1985 the company filed for bankruptcy and the facility ceased operation.

Large quantities of the ore concentrates were left on site in various processed and unprocessed forms. The ore which is present in drums, wooden crates and piles both inside and outside the buildings, contains heavy metals and radioactive isotopes of uranium, thorium, and radium. Many of the drums and crates located outside are weathered and/or corroded to a point where the contents have spilled on the ground. In other areas, the drums have been over-stacked and have become very unstable as the drums deteriorated and corroded.

Numerous aboveground wooden, steel or fiberglass tanks were used during the various smelting processes, and to store reactants (e.g., hydrochloric acid, ammonia, hydrogen) and/or intermediate compounds (e.g., ammonium paratungstate or APT). Some of these tanks may still contain some hazardous and inorganic liquids. As the tungsten ore moved through its various processing stages, the radioactive isotopes became more concentrated in the residual waste or slag. There are indications that some of this slag was placed in waste piles at the ground surface and/or buried on site (NUS, 1989; 1990). Heavy metals which constitute impurities that were removed during the extraction process include: antimony, arsenic, barium, bismuth, copper, cobalt, chromium, lead, manganese, mercury, molybdenum, nickel, thorium, uranium, vanadium, and zinc.

Several of the buildings on site have deteriorated to a point where they represent a physical safety hazard. Portions of some walls and roofs have collapsed. In addition, friable and non-friable asbestos is present as pipe wrap, tank insulation, siding shingles, and roof tiles. Standing water in the West Dice Building has flooded and concealed a deep pit in the floor.

Previous Site Investigations

Various site investigation activities were conducted at the site between 1988 and 1990 by the Nassau County Department of Health (NCDOH), the New York State Department of Environmental Conservation (NYSDEC), the potentially responsible parties (PRPs), and the United States Environmental Protection Agency (USEPA). Results of these sampling activities have indicated the presence of heavy metals, fuel oil constituents, and volatile organics in the groundwater, surface water, sediments and soils.

Current Conditions

The Li Tungsten site ceased operations in June 1985 and has been inactive since. Site security (fencing and guard) was addressed as one of the interim remedial measures in the AOC. Although a one person security guard is maintained on a 24-hour basis, the site could be entered without the knowledge of the security force through breaks in the fence. During the site tour, observations were made that vandalism has occurred. Many of the salvageable fixtures (e.g., copper wiring and piping) have been removed and general debris (e.g., washing machines, mattresses) have been left behind.

OBJECTIVE OF THE RI/FS

This Remedial Investigation/Feasibility Study (RI/FS) is designed to collect sufficient data on the nature and extent of contamination to remediate the site. In achieving this objective, these data will be used to determine contamination sources, identify migration pathways, perform an assessment of human health and ecological risks, and support the selection of remedial alternatives to mitigate or reduce risks in accordance with the requirements of the National Contingency Plan (NCP) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Re-authorization Act of 1986 (SARA).

The Health and Safety Plan (HASP), and Field Operations Plan (FOP), which includes the Quality Assurance Project Plan (QAPP) and the Field Sampling Plan (FSP), will be prepared after the Work Plan has been approved by the USEPA.

INITIAL EVALUATION

The contamination at the Li Tungsten site exists in the groundwater, soil, surface water and sediments. The groundwater contains VOCs and inorganic compounds. The major VOCs contamination is present in two areas and may be related to two off-site sources. The inorganic contamination on-site is a result of the past facility operations and disposal practices. Drums, crates and piles of processed ore and slag will continue to act as contaminant source to the groundwater until they are removed. The disposal area in Parcel B, the two Mud Holes, the Mud Pond and the storm drains are also potential contaminant sources.

The surface water contamination consists mostly of inorganic compounds and relative low levels of VOCs. Continuing sources to surface water contamination consists of runoff from the residual ores, the disposal area in Parcel B, and the storm drains.

During site visits, several safety related observations were made. These observation related to obstructions and site conditions that would affect worker safety in the performance of RI field investigation tasks. To eliminate these safety hazards, we propose that additional interim remedial actions be implemented to address each of the safety hazards, before RI field investigation tasks are initiated.

FIELD INVESTIGATION

Overall Objective

The purpose of the field investigation is to obtain valid data to evaluate the potential sources of contamination by defining the nature, depth and extent of contamination resulting from operations at the site. In addition, the field investigation will assess migration pathways from the sources and evaluate the potential contribution from the adjacent Mattiace Petrochemical site and a former dry cleaning establishment.

The data generated during the field investigation will be used to assess what risks, if any, the contamination resulting from operations at the Li Tungsten site presents to public health and to the environment. Based on these data, it will be determined whether site conditions warrant a remedial action. Finally, the data will be used to evaluate appropriate remedial response alternatives for the site.

The following field surveys and activities will be conducted:

Surface Features Investigation

The surface features investigation proposed in this Work Plan includes a site reconnaissance and field verification of previously identified features. The investigation focuses on surface features that are potential sources and migration routes of contaminants and include the aboveground storage tank, the Mud Pond, the two Mud Holes, and various disposal areas.

Subsurface Features Investigation

A magnetometer and/or electromagnetic (EM) survey is proposed to provide information on potential buried drums, tanks, or other subsurface features in selected parts of the site. The magnetometer survey will be useful in attempting to locate reported underground storage tanks in the absence of surface features (i.e., vent pipes or fill pipes). The EM survey will be used in areas where surface features (e.g., near buildings, steel-reinforced concrete slabs) that may interfere with the magnetometer survey.

To better delineate the configuration of the clay surface on the site, additional deep borings are proposed to be drilled. These borings should provide information needed to further define depth of vertical contaminant movement, assess the extent to which the clay acts as a confining unit, and enhance the understanding of the groundwater flow regime.

Soils and Vadose Zone Investigation

The soils and vadose zone investigation proposed consists of a soil boring program and a test pit program. The objective of the soil boring investigation is to provide information on the vertical limits of the reported buried waste in the Parcel B disposal area, assess the presence, nature and extent of contamination in the vadose zone, and further characterize the site stratigraphy. The objective of the test pits around the disposal area in Parcel B is to assess the subsurface extent of disposal activities and to collect samples of soil and buried waste.

Hydrogeological Investigation

A hydrogeologic investigation is proposed to further delineate the vertical and lateral extent of contamination, to refine the understanding of the groundwater flow system, and to estimate aquifer parameters. An understanding of these site characteristics is needed to determine the scope of potential remedial actions.

Monitoring wells are proposed to collect groundwater samples for chemical analysis, to measure groundwater elevations to estimate the direction of groundwater flow, to conduct hydraulic conductivity tests to estimate hydraulic characteristics of the upper glacial aquifer, and to delineate the top of the clay confining unit. Ten new monitoring wells (three shallow, seven deep) will be installed. Additional shallow monitoring wells may be installed depending on the results of the soil gas survey and the soil boring program.

In-situ hydraulic conductivity testing are proposed using two methods: slug tests and pumping tests. Rising and falling head slug tests are proposed on each monitoring well. The slug test data will be used to obtain an order-of-magnitude estimate of the hydraulic conductivity of the water bearing material immediately around the well screen and will be compared to, and used in, conjunction with pumping test data and published information. A pumping test is proposed to further define the groundwater hydrology and as an aid in evaluating contaminant fate and transport. The pumping well location and the type of test to be conducted will be determined following evaluation of the monitoring well survey and the slug test data.

Meteorological Investigation

A portable wind vane/anemometer is proposed during the intrusive phases of the RI to estimate the wind direction and speed. Further meteorological investigations are not planned at this time. If significant air borne contamination is detected, further meteorological data such as temperature, relative humidity, and barometric pressure, will be collected for the purpose of conducting the site health risk assessment.

Cultural Resources Survey

The field investigation also includes a Cultural Resource Survey (CRS) for a Stage 1A (Literature Search and Sensitivity Study) Survey. The Stage 1A investigation includes a literature and archival search of historical, archaeological, architectural, or culturally significant properties.

Ecological Survey

An ecological investigation of the site and adjacent properties is proposed to characterize existing on-site conditions relative to vegetation community structure, wildlife utilization and sensitive resources such as surface waters and wetlands. This investigation may identify discernable contaminant pathways and biological/ecological related ARARs. This information, together with surface and groundwater data will be used to assess potential adverse effects resulting from identified on-site contaminants and also to assess the ecological effects/impacts of proposed remedial alternatives.

Soil Gas Survey

A soil gas survey is proposed on parts of Parcel A where previous investigations have identified a contaminant plume to further delineate the extent of the plume and its migration. Results of the soil gas survey will be used to identify potential locations for additional monitoring wells. The monitoring wells will allow for continued monitoring of the movement of the plume.

Groundwater Sampling

Groundwater samples are proposed from new and existing monitoring wells and analyzed to obtain data on groundwater quality on and around the site. Two rounds of groundwater sampling are proposed. The second round is intended to confirm the results of the first round and to check for possible temporal variations. Water levels will be measured and recorded before purging the wells. The samples will be analyzed for TAL/TCL compounds, dissolved and total tungsten, total cyanide, total dissolved solids (TDS) and radiological parameters (^{230}Th , ^{232}Th , ^{226}Ra , ^{228}Ra , and ^{238}U). Conductivity, pH, and temperature of the groundwater will be measured in the field.

Soil Sampling

Soil sampling is proposed at 12 locations to assess the dermal/inhalation pathway, and during test pit excavation to evaluate if the soils represent a potential source of groundwater contamination. In addition, a subsurface soil sampling program (soil borings) is proposed at five general locations: in the disposal area in Parcel B; in the area of scarred vegetation in Parcel C; around the 500,000-gallon aboveground storage tank; beneath paved areas in Parcel A; and along selected stormwater and process drains.

Surface Water Sampling

To confirm the presence of the inorganic contamination in the surface water on the site, new surface water samples are proposed at previous surface water sampling locations. In addition, the intermittent stream/drainage ditch on Parcel C will also be sampled during a time of flowing water. These data may provide information on possible changes in concentrations over the time period between sampling events.

Radiological Characterization

The radiological field investigations have been segmented into Phase I and Phase II activities. The objective of the radiological survey is to characterize the location, quantity, and types of radioactive contaminants in soil, process materials, equipment, building materials, and tanks. Activities including screening measurements (Phase I) as well as detailed characterization of the radionuclide concentrations in these media (Phase II).

Downhole gamma logging of boreholes is proposed to characterize the extent (i.e., depth and volume) of radiological contamination. Existing data indicate that the building structural components and factory equipment are not contaminated with radioactive materials. However, some sampling will be conducted based on the Phase I gamma radiation scans/surveys of building floors and walls, which will identify potentially

contaminated materials. Areas identified with elevated exposure rates will be targeted for sample collection. In most cases, samples of concrete walls or floors will be collected by chipping pieces with a jackhammer or other suitable tool. The samples will be analyzed for ^{232}Th and other members of the uranium and thorium decay series.

Characterization of radionuclide contents in all of the tanks is proposed. The objective of the tank sampling is twofold: (1) to determine whether each tank would require disposal as radioactive waste in its current condition, and (2) to evaluate the possibility of decontamination of radioactivity from interior tank surfaces.

Groundwater sampling is proposed to evaluate on-site groundwater quality and potential off-site migration of radionuclides. Groundwater samples will be collected and analyzed for isotopes of thorium, radium, and uranium.

1.0 INTRODUCTION

1.1 Overview

The Li Tungsten Corporation (Li Tungsten) site is an inactive 26 acre site located at 63 Herb Hill Road, City of Glen Cove, Nassau County, New York (USEPA ID #NYD9868826-60). From early 1940's until approximately 1985, tungsten ores or concentrates, imported primarily from mainland China, South America and Canada, were smelted at this facility for the production of tungsten carbide powder, tungsten wire, and welding rods (NUS, 1989; 1990). In 1985 the company filed for bankruptcy and the facility ceased operation.

Large quantities of the ore concentrates were left on site in various processed and unprocessed forms. The ore which is present in drums, wooden crates and piles both inside and outside the buildings, contains heavy metals and radioactive isotopes of uranium, thorium, and radium. Many of the drums and crates located outside are weathered and corroded to a point where the contents have spilled on the ground. In other areas, the drums have been overstacked and have become very unstable as the drums deteriorated and corroded. Since many of the drums contain radioactive material, they represent both a potential health hazard as well as a physical safety hazard.

The amount of extractable tungsten in a specific ore is dependent on the ore characteristics and the mineral assemblages of the ore. While tungsten occurs in 29 known mineral species, numerous isomorphous substitutions are possible within the tungsten minerals. It was necessary during the smelting, therefore, to be able to vary the extraction process to separate the various accessory metals (or impurities) depending upon the specific type of ore or concentrate that was imported. The smelting was generally conducted in relatively small batches, to permit any individual or combination of extraction treatments. Typical treatments in the smelting included physical, chemical and mechanical processes including: sizing and crushing; gravity, magnetic and electrostatic separation; roasting; leaching; floatation; and fusion. An analytical laboratory was located on site to perform chemical analysis on the ore and pilot testing of the extraction treatments.

Numerous aboveground wooden, steel or fiberglass tanks were used to perform the extraction treatments and to store reactants (e.g., hydrochloric acid, ammonia, hydrogen)

and/or intermediate compounds (e.g., ammonium paratungstate or APT). Some of these tanks may still contain some hazardous and inorganic liquids. As the tungsten ore moved through its various processing stages, the radioactive isotopes became more concentrated in the residual waste or slag. There are indications that some of this slag was placed in waste piles at the ground surface and/or buried on site (NUS, 1989; 1990). Heavy metals which constitute impurities that were removed during the extraction process include: antimony, arsenic, barium, bismuth, copper, cobalt, chromium, lead, manganese, mercury, molybdenum, nickel, thorium, uranium, vanadium, and zinc.

Many of the buildings on site have deteriorated to a point where they are not considered safe to enter. Portions of some walls and roofs have collapsed. Friable and non-friable asbestos is present as pipe wrap, tank insulation, siding shingles, and roof tiles. Standing water in the West Dice Building has flooded a deep pit in the floor.

Various site investigation activities were conducted at the site between 1987 and 1990 by the Nassau County Department of Health (NCDOH), the New York State Department of Environmental Conservation (NYSDEC), the potentially responsible parties (PRPs), and the United States Environmental Protection Agency (USEPA). Results of these sampling activities have indicated the presence of heavy metals, fuel oil constituents, and volatile organics in the groundwater, surface water, sediments and soils.

This Remedial Investigation/Feasibility Study (RI/FS) is designed to collect sufficient data on the nature and extent of contamination to remediate the site. In achieving this objective, these data will be used to determine contamination sources, identify migration pathways, perform an assessment of human health and ecological risks, and support the selection of remedial alternatives to mitigate or reduce risks in accordance with the requirements of the National Contingency Plan (NCP) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

1.2 Approach to Development of Work Plan

Malcolm Pirnie, Inc., (MPI) is submitting this Work Plan to the USEPA in response to Work Assignment #025-2L4L under the Alternative Remedial Contracting Strategy (ARCS)

Contract No. 68-W9-0051. This Work Plan presents the proposed technical scope of work for the RI/FS and includes a schedule for the performance of the work.

This Work Plan has been prepared in accordance with current USEPA guidance. The following are several of the documents specifically applicable to preparation of an RI/FS that were considered in preparing this Work Plan:

- Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, OSWER Directive 9355.3-01. (USEPA, 1988a)
- Data Quality Objectives: Development Guidance for Uncontrolled Hazardous Waste Site Remedial Response Activities, OSWER Directive 9355.0-7B, (USEPA, 1987a).
- Interim Guidance of Superfund Selection of Remedy, OSWER Directive 9355.0-19, (USEPA, 1986a).
- Additional Interim Guidance for FY-87 Records of Decision, OSWER Directive 9355.0-21, (USEPA, 1987b).
- Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual Part A (USEPA, 1989a).
- Risk Assessment Guidance for Superfund, Volume II, Environment Evaluation Manual (USEPA, 1989b).
- Superfund Exposure Assessment Manual (USEPA, 1986b).
- Draft Generic Work Plan Guidance (USEPA, 1989c).
- CERCLA Compliance with Other Laws Manual, Interim Final. EPA/540-/G-89/006. Office of Emergency and Remedial Response, Washington, D.C. August 1988, 195 pp, (USEPA, 1988b).
- Guide for Conducting Treatability Studies Under CERCLA (Interim Final) EPA/540/2-89/058, December 1989, 138 pp, (USEPA, 1989d).

Preparation of this Work Plan was based upon a review and consideration of data, information, and discussions related to the following:

- Two site visits by MPI personnel on September 1, 1992 and February 3, 1993.

- USEPA comments on the Draft Work Plan, letter dated December 24, 1992 and subsequent discussions.
- Scoping meeting with the USEPA held on September 3, 1992.
- Li Tungsten Site Investigation Report. Prepared for Compton Reality Corporation, New York, NY by RTP Environmental Associates, Inc., Westbury, NY, May 1988, 2 volumes (RTP, 1988).
- Final Draft, Preliminary Assessment, Li Tungsten, Glen Cove, NY. Revision No. 1 dated October 18, 1989 with Appendices (NUS, 1989).
- Final Draft, Site Inspection Report, Li Tungsten, Glen Cove, NY. September 28, 1990 with Appendices (NUS, 1990).
- Interim Remedial Actions Report. Prepared for Glen Cove Development Company, April 4, 1990 (HART, 1990).
- Final Remedial Investigation Report, Mattiace Petrochemical Site, Operable Unit One, Glen Cove, NY. Volumes I and II (EBASCO, 1991).
- Topographic Map - Sea Cliff, NY Quadrangle, 1:24,000, Photorevised 1979 (USGS, 1979).

1.3 Scope of Work

The scope of work for this Work Plan was outlined in the Work Assignment Form and Statement of Work which was transmitted to MPI from the USEPA in a letter from the Contracting Officer (CO) dated August 26, 1992. The Statement of Work identified the following tasks:

- Review existing background documents provided by USEPA.
- Develop an RI/FS Work Plan that is comprehensive enough to support a Record of Decision (ROD) for the entire study area.
- Attend scoping meeting within 10 days after issuance of the work assignment.

1.4 Work Plan Content

This Work Plan is organized into nine sections of text including references and a glossary. A brief description of each section follows.

Section 1.0, **INTRODUCTION**, presents an overview of the environmental conditions at the site, the approach used in developing the Work Plan, the scope of work, and the organization and content of the Work Plan.

Section 2.0, **SITE BACKGROUND AND SETTING**, presents the background of the site including the location, history and current conditions.

Section 3.0, **INITIAL EVALUATION**, presents an initial evaluation of the existing data base. This section includes a description of the types of waste present, site hydrogeology, climate, population and environmental resources, migration and exposure pathways, a preliminary identification of applicable or relevant and appropriate requirements (ARARs), a preliminary assessment of public health and environmental impacts, a summary of additional data requirements, remedial action objectives, and recommendations for interim remedial actions to be completed before the RI is initiated.

Section 4.0, **WORK PLAN RATIONALE**, includes the Data Quality Objectives (DQOs) for RI sampling and analytical activities, and the approach for preparing the Work Plan, which illustrates how the activities will satisfy data needs.

Section 5.0, **TASK PLANS FOR RI/FS**, presents a proposed scope for each standard task of the RI/FS in accordance with the RI/FS guidance document (USEPA 1988a).

Section 6.0, **PROJECT SCHEDULE**, presents the anticipated schedule for the RI/FS tasks.

Section 7.0, **PROJECT MANAGEMENT APPROACH**, presents project management considerations that define relationships and responsibilities for selected task and project management teams.

Section 8.0, **REFERENCES**, provides a list of references used to develop material presented in this Work Plan.

Section 9.0, **GLOSSARY OF ABBREVIATIONS**, provides a glossary of abbreviations and acronyms used in this Work Plan.

The Health and Safety Plan (HASP), and Field Operations Plan (FOP), which includes the Quality Assurance Project Plan (QAPjP) and the Field Sampling Plan (FSP), will be prepared after the Work Plan has been approved by the USEPA.

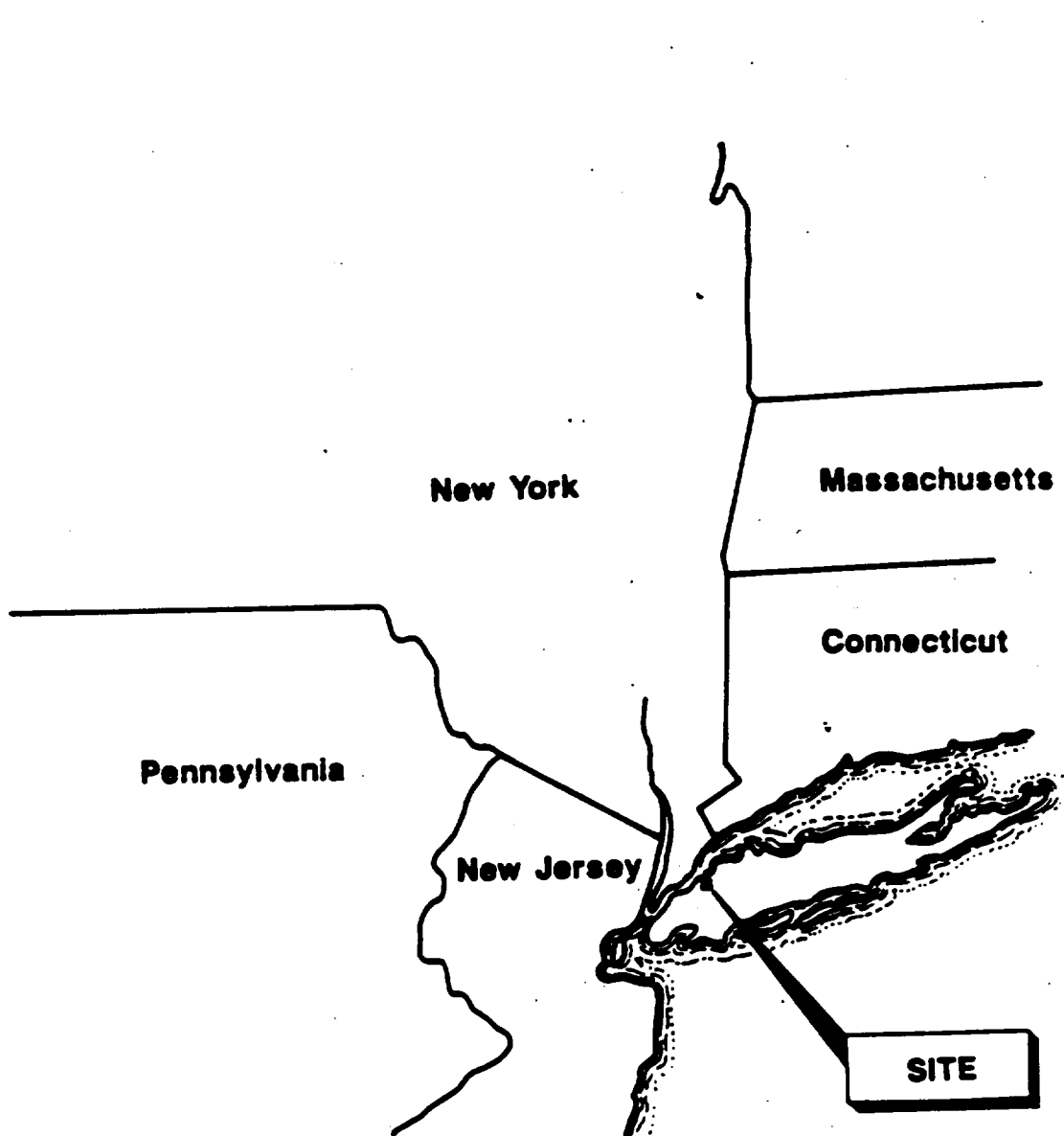
2.0 SITE BACKGROUND AND SETTING

2.1 Site Location

The Li Tungsten site is located at 63 Herb Hill Road in the City of Glen Cove, Nassau County, Long Island, New York. A regional map and a site location map are provided in Figures 2-1 and 2-2, respectively. The geographic coordinates of the site are latitude 40°51'36" North and longitude 73°38'25" West. Also located on Figure 2-2 is the adjacent Mattiace Petrochemical site which is on the National Priorities List (NPL) and was the subject of a recently completed RI/FS directed by the USEPA (EBASCO, 1991).

The site is approximately 26 acres and consists of four (4) separate parcels designated A, B, C and C'. For the purpose of this Work Plan and subject to the findings of the field investigation, the study area is defined as the entire 26 acres. The location of Parcels A, B, C and C' and the significant site features on each parcel are shown on the site plan in Figure 2-3.

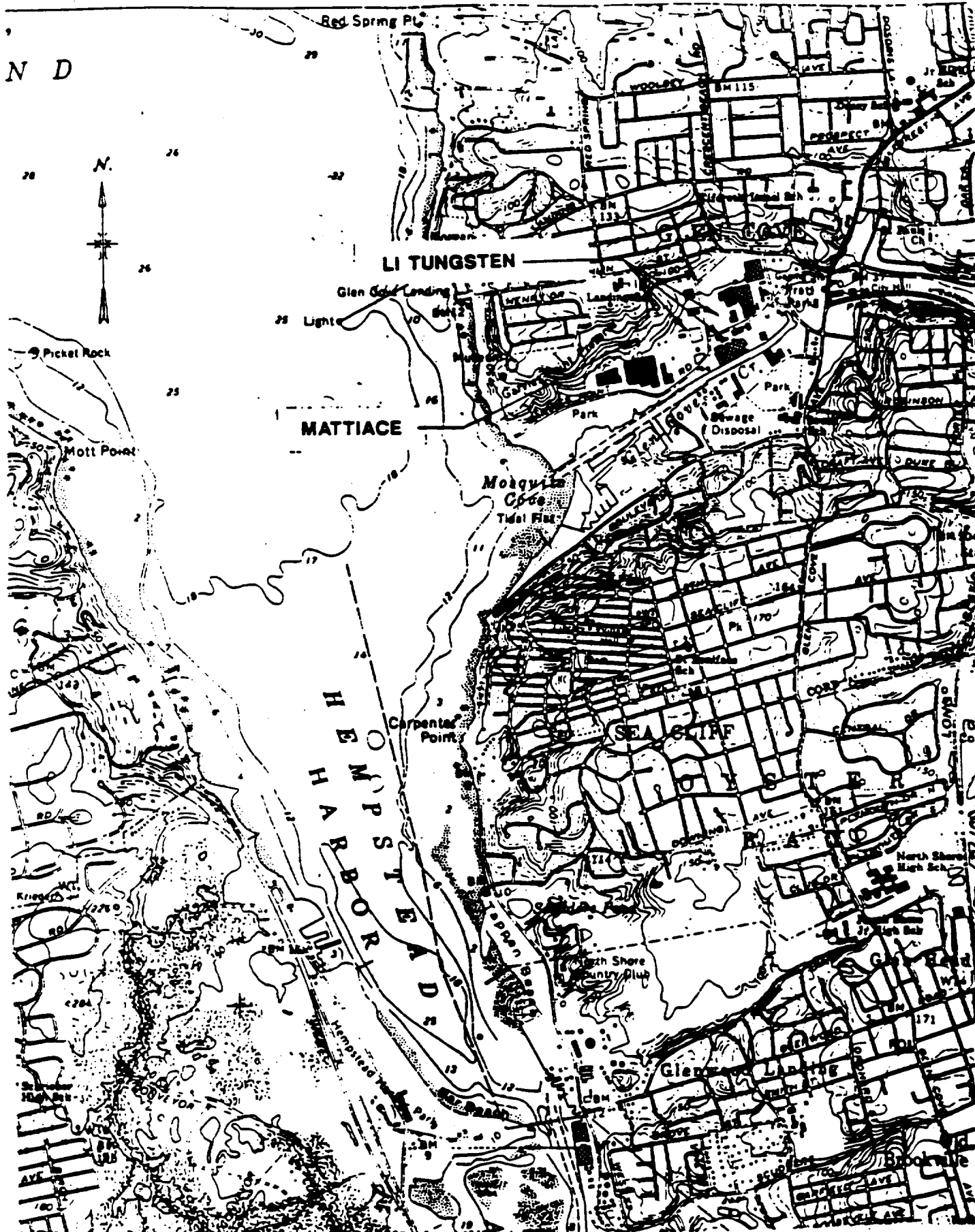
Parcel A is approximately seven acres and served as the main operations center when the site was active. It contains the majority of buildings, structures (e.g., tanks, two surface impoundments) and drums/crates of tungsten ore. It is bounded by Herb Hill Road on the north, Garvies Point Road on the west, an adjoining property on the east, and Glen Cove Creek on the south. Parcel B is the smallest of the three parcels, approximately six acres, and is located due north of Parcel A. Parcel B is bounded by Herb Hill Road on the south, Dickson Lane on the west, The Place on the north, and an adjoining property on the east. The area south of the pond on Parcel B was used primarily as a parking lot when the plant was active, however, disposal activities also are believed to have taken place north of the pond (RTP, 1988). The disposal area north of the pond on Parcel B has been referred to in previous reports (HART, 1990; NUS, 1989, 1990, 1991) as a "landfill". Observations made during the second site visit confirmed that disposal activities have taken place in that portion of Parcel B, but insufficient information is available to confirm that actual landfilling operations took place. Further references to this area in the Work Plan text and on figures, therefore, will refer to it as a disposal area. Parcel C is the largest of the three parcels, approximately 14 acres, however, not all of this parcel was part of the Li Tungsten property during active site operations. The Glen Cove Development Corporation (GCDC) acquired



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MALCOLM
PIRNIE

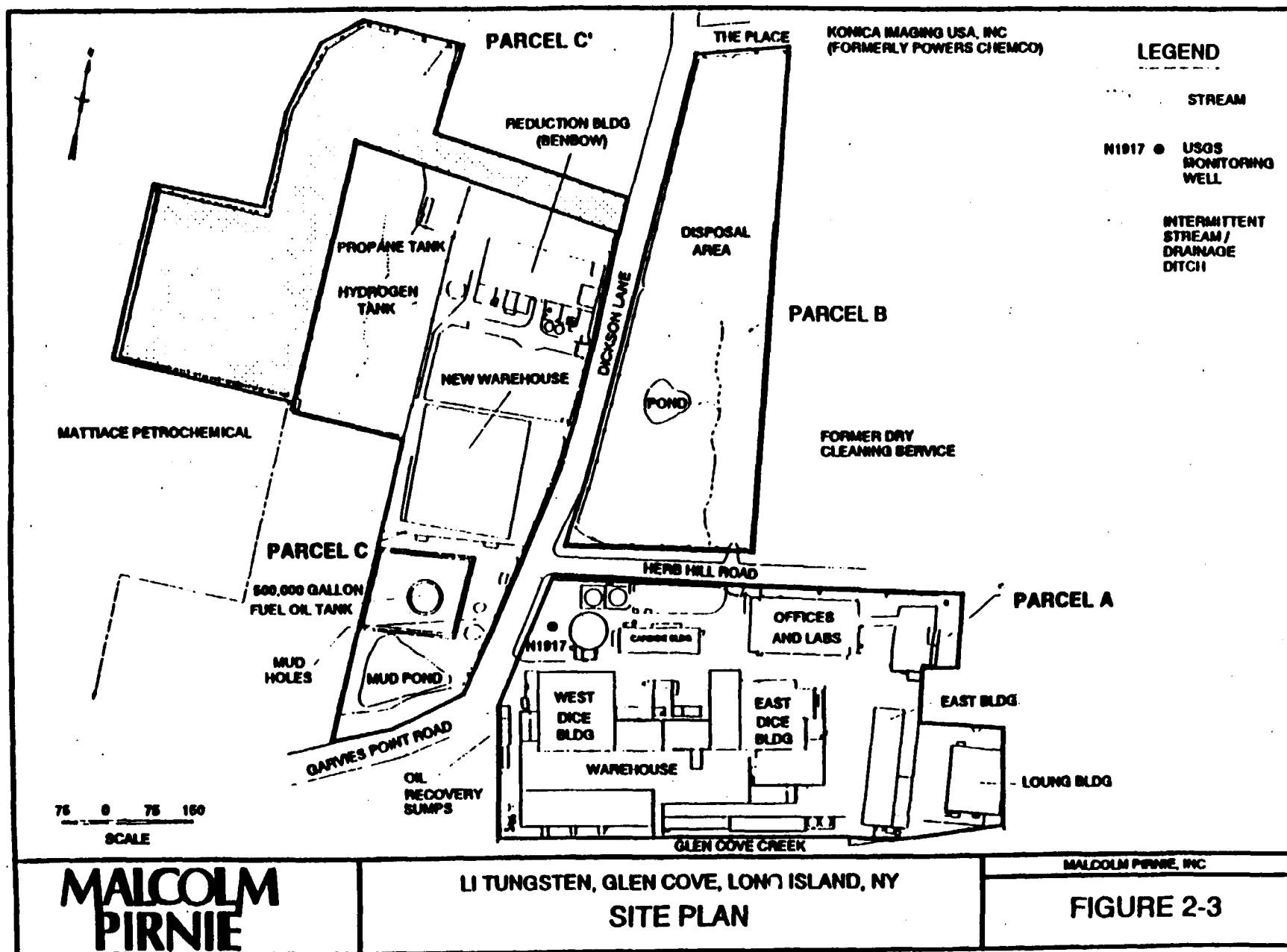
LI TUNGSTEN
GLEN COVE, NEW YORK
REGIONAL LOCATION MA



SOURCE: USGS MAP SEA CLIFF, NEW YORK QUAD., 1979

LI TUNGSTEN
 GLEN COVE, NEW YORK
 SITE LOCATION M
 SCALE 1"=2000'
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approximately four acres of undeveloped property, designated Parcel C', sometime after 1984. Parcel C contains several buildings, a 500,000 gallon aboveground fuel oil storage tank, and three surface impoundments (e.g., Mud Pond and two Mud Holes) used to dispose of process waste water.

2.2 Site History

This site has a complex history of name and ownership changes, and environmental site assessments, investigations and removal actions. Specific details are discussed in the paragraphs below. The chronological history of site ownership, operations, and preliminary investigations/interim remedial actions is summarized in Table 2-1.

Early in the 1940's the National Reconditioning Company was formed by Kuo Ching (K.C.) Li. The company was operated and managed by the Wah Chang Trading Corporation of New York. In addition to being the chairman and chief engineer of Wah Chang Trading Corporation, K. C. Li was also a distinguished mining engineer, discoverer of tungsten in China, and was responsible for first importing tungsten into the United States. The purpose of the company was to build a facility in Glen Cove, NY, to concentrate tungsten ores.

The facility became operational in 1942. Operation consisted of processing raw ore and scrap tungsten concentrates to produce ammonium paratungstate (APT) and subsequently formulating APT to metal tungsten powder and tungsten carbide powder. Other specialty products that were produced included: tungsten carbide powder for plasma spraying; tungsten titanium carbide powder; tantalum carbide powder; tungsten spray powder; crystalline tungsten powder; and molybdenum spray powder.

Based on available information, a variety of extraction processes (or treatments) were used to separate the various accessory metals (or impurities) from the tungsten depending upon the specific type of ore or concentrate that was imported. The smelting was generally conducted in relatively small batches, to permit any individual or combination of extraction treatments. Typical treatments in the smelting process included physical, chemical and mechanical processes such as: sizing and crushing; gravity, magnetic and electrostatic

TABLE 2-1
CHRONOLOGY OF EVENTS AND SITE INVESTIGATIONS
Li Tungsten Site
Glen Cove, New York

<u>DATE</u>	<u>EVENT</u>
1940	National Reconditioning Corporation was formed by K. C. Li with the express purpose of building the Glen Cove facility.
1942	Facility becomes operational. Operation consisted of processing raw ore and scrap tungsten concentrates to produce ammonium paratungstate (APT) and subsequently formulating APT to metal tungsten powder and tungsten carbide powder. Other specialty products including tungsten carbide powder plus cobalt and other material for plasma spraying; tungsten titanium carbide powder; tantalum carbide powder; tungsten spray powder; crystalline tungsten powder; and molybdenum spray powder were also produced.
1948	National Reconditioning Corporation changes its name to Wah Chang Smelting and Refining Corporation (WCSRC).
1948 - 1964	Site operated by WCSRC.
1964	WCSRC leases equipment/property to the Wah Chang Corporation (WCC) which continued to operate the facility.
April 1967 - 1972	Teledyne acquired the stock of WCC and the two companies merged. Operations at the site continued by Teledyne-Wah Chang Corporation.
1972	WCSRC formed a wholly owned subsidiary (Li Tungsten Corporation) which operated the facility until filing for bankruptcy in 1985.
1984	Property acquired by the Glen Cove Development Company (GCDC). GCDC is a general partnership duly organized and existing under the laws of the State of New York and is owned by the Old Court Holdings Company and the Old Court Joint Ventures, Inc., both of which, in turn, are wholly-owned subsidiaries of Old Court Savings and Loan, Inc., (in Receivership) located in Maryland

TABLE 2-1 (continued)
CHRONOLOGY OF EVENTS AND SITE INVESTIGATIONS
Li Tungsten Site
Glen Cove, New York

<u>DATE</u>	<u>EVENT</u>
1984	GCDC continues to lease the site to Li Tungsten Corporation. Market for tungsten in decline.
June 1985	Li Tungsten Corporation files for bankruptcy. Manufacturing operations at the facility cease.
May 1988	RTP Environmental Associates, Inc., (Westbury, NY) completes Site Investigation Report for Campon Reality Corporation (RTP, 1988). Site investigation undertaken to evaluate environmental conditions prior to residential development. Geraghty and Miller was subcontracted to perform the hydrogeology investigation.
March 29, 1989	New York State Department of Environmental Conservation (NYSDEC) performs site inspection.
April 14-16, 1989	USEPA assumes lead enforcement role on response actions at the site. USEPA FIT2 contractor (NUS) initiates Preliminary Assessment.
July 21, 1989	Administrative Order On Consent (AOC) issued by USEPA to Glen Cove Development Corporation which specified nine (9) interim remedial actions.
September 18, 1989	USEPA FIT2 contractor (NUS) issues Preliminary Assessment Report (NUS, 1989).
April 4, 1990	Interim remedial actions completed and final report submitted (HART, 1990).
September 28, 1990	USEPA FIT2 contractor (NUS) issues Site Inspection Report (NUS, 1990).
July 1991	Li Tungsten site proposed for inclusion on the National Priorities List (NPL).
February 12, 1992	Special Notice letters were sent by USEPA to five PRPs (Teledyne, Inc.; Li Tungsten Inc.; the Glen Cove Development Corporation; Wah Chang Smelting and Refining Corporation; and Mr. John Li (son

TABLE 2-1 (continued)
CHRONOLOGY OF EVENTS AND SITE INVESTIGATIONS
Li Tungsten Site
Glen Cove, New York

DATE

EVENT

August 26, 1992

of Mr. K. C. Li). These letters solicited the involvement of the PRPs in the investigation of the site.

Malcolm Pirnie receives work assignment to prepare RI/FS Work Plan.

separation; roasting; leaching; floatation; and fusion. A generalized flow sheet of the treatment processes is shown in Figure 2-4.

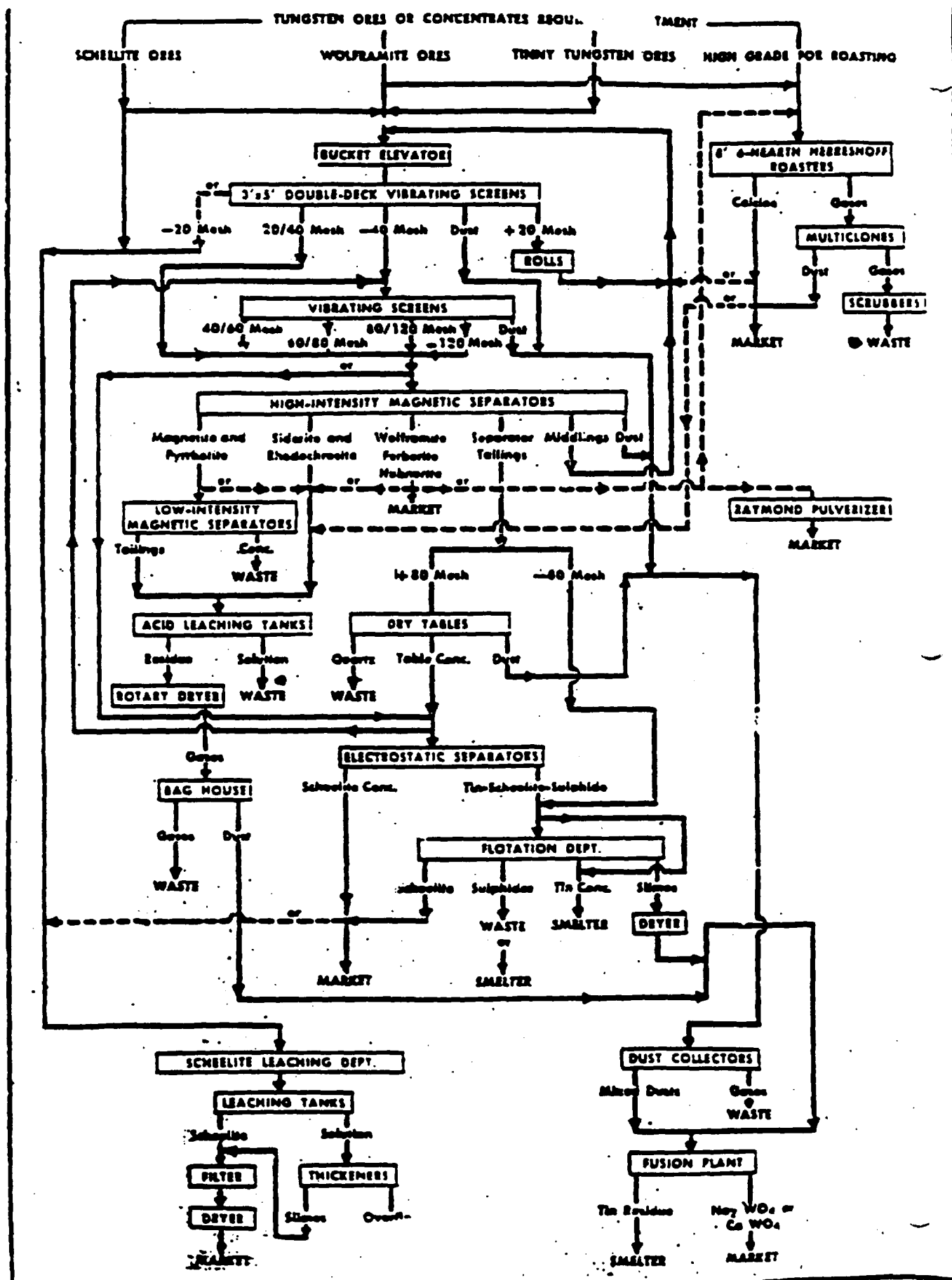
Numerous aboveground wooden, steel or fiberglass tanks were used in performing some of these treatments and to store reactants (e.g., hydrochloric acid, ammonia, hydrogen) and/or intermediate compounds (e.g., APT). Many of these tanks still contain some hazardous and inorganic liquids. As the tungsten ore moved through its various processing stages, the naturally occurring radioactive isotopes of thorium, uranium, and radium became more concentrated in the residual waste or slag. There are indications that some of this slag was placed in waste piles at the ground surface and buried on site (NUS, 1989; 1990). Accessory metals which constitute the impurities that were removed during the extraction process include: antimony, arsenic, barium, bismuth, copper, cobalt, chromium, lead, manganese, mercury, molybdenum, nickel, thorium, uranium, vanadium, and zinc.

In 1948 the National Reconditioning Company changed its name to Wah Chang Smelting and Refining Corporation (WCSRC). WCSRC continued to operate the site until 1964 when they leased the equipment and property to Wah Chang Corporation (WCC). In 1966 Teledyne acquired the stock of WCC and the two companies merged. Operations at the site continued by Teledyne-Wah Chang Corporation.

In 1972 WCSRC, which had been leasing the equipment and property to Teledyne-Wah Chang Corporation, formed a wholly owned subsidiary (Li Tungsten Corporation) which continued to operate the facility. In 1984 the property was acquired by GCDC. GCDC is a general partnership duly organized and existing under the laws of the State of New York and is owned by the Old Court Holdings Company and the Old Court Joint Ventures, Inc., both of which, in turn, are wholly-owned subsidiaries of Old Court Savings and Loan, Inc., (in Receivership) located in Maryland. GCDC continued to lease the site to Li Tungsten Corporation until 1985 when Li Tungsten Corporation ceased operations at the site and filed for bankruptcy.

There is very little specific documented knowledge on waste volumes that were generated or waste disposal practices. Drummed waste is also reported to have been buried on-site in a portion of Parcel B (NUS, 1989, 1990). Liquid wastes are believed to have been disposed of through numerous subsurface drainage pipes that have been noted in the

FLWSHEET OF WAH CHANG'S PLANT FOR CONCENTRATING TUNGSTEN



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FIGURE 2-4

bulkhead and empty directly in Glen Cove Creak. State Pollution Discharge Elimination System (SPDES) permits allowed for up to as many as 250,000 gallons per day of discharge to Glen Cove Creek. Mud Pond and the two Mud Holes were also reportedly used to dispose of liquid wastes.

On April 14, 1989 the USEPA received a request from the NYSDEC to use its Superfund authority to respond to threats posed by hazardous materials at the site. USEPA's preliminary assessment and site inspection of site conditions (NUS, 1989; 1990), revealed a large quantity of slag which was emitting low-level beta-gamma radiation. In addition, large quantities of laboratory reagents, various hazardous materials in drums and tanks, asbestos, transformers, and cylinders containing compressed liquids and gases were found in several buildings. Air monitoring showed no dangerous levels of organic compounds either on site or off-site. As a result of the conditions identified at the site, the USEPA issued an Administrative Order on Consent (AOC) to GCDC to stabilize all potential threats to the public and the environment.

Fred C. Hart Associates, Inc., (HART) was hired by GCDC to coordinate the nine (9) interim remedial actions identified in the AOC (HART, 1990). Additional removal/remedial actions were also undertaken by GCDC. A list of the interim remedial actions and the additional actions completed at the site is summarized in Table 2-2.

The Hazard Ranking Score (HRS) for the Li Tungsten site was 50.00 which is above the 28.5 threshold value for inclusion on the NPL (NUS, 1991). In July 1991 the Li Tungsten site was proposed for inclusion on the NPL and in October 1992, the site was placed on the NPL.

2.3 Current Conditions

The Li Tungsten site ceased operations in June 1985 and has been inactive since. Site security (fencing and guard) was addressed as one of the interim remedial measures in the AOC. Although a security guard is present on-site 24 hours a day, the site could be entered without knowledge of the security guard through breaks in the fence. During the site visits, observations were made that trespassing has occurred. Many of the salvageable fixtures

TABLE 2-2
SUMMARY OF INTERIM REMEDIAL ACTIONS AND
ADDITIONAL REMOVAL ACTIONS

Li Tungsten Site
Glen Cove, New York

AOC Specified Tasks

The AOC contained a schedule for completion of the nine tasks listed below. There is insufficient information available to determine exactly when these activities were completed, but generally they occurred between the date the AOC was signed on July 21, 1989 and the date the Remedial Action Report was issued on April 4, 1990.

Site Security

- Repairs were made to all existing fences and gates. New fence was installed in two areas. All gates were made functional and fitted with locks.

Radioactive Materials

- Twelve (12) drums (or 113 cubic feet) of equipment, thorium metal and other materials (HART, 1990, p.13), plus a small furnace were removed by NDL on December 11, 1989.
- Twenty (20) yards of radioactive process ore slag was relocated to a secure area within the Dice building (HART, 1990, p.13).

Laboratory Chemicals

- Fifty-two (52) 55-gallon and 80-gallon overpacks and twenty (20) 5-gallon pails of labeled laboratory chemicals were prepared for shipment to Cycle Chem.
- Eight (8) 55-gallon drums of unknown liquid laboratory chemicals were placed in the staging area.
- One (1) 55-gallon drum of unknown solid laboratory chemicals were placed in the staging area.

Drummed Chemicals

- The liquids from approximately 150 - 200 unknown drums were bulked for removal and disposal (HART, 1990, p24).

Tank Characterization

- A total of 223 tanks were identified on the three site parcels [A - 197 tanks (112 empty); B - 6 tanks (all empty); and C - 20 tanks(14 empty)] (HART, 1990, p. 35).
- Disposal of tanks was not specified as part of IRA (HART, 1990, p.24).

TABLE 2-2 (continued)
SUMMARY OF INTERIM REMEDIAL ACTIONS AND
ADDITIONAL REMOVAL ACTIONS
Li Tungsten Site
Glen Cove, New York

Asbestos Sampling

- Five (5) high volume air samples were collected (Carbide Building; West Dice Building; Loung Building; Dickson Warehouse; and Benbow Building) and analyzed by transmission electron microscopy (TEM) with no indication of airborne asbestos (HART, 1990, p. 57).
- Fifty-one bulk samples were collected from Parcels A and C and analyzed by polarized light microscopy (PLM). Slightly more than half of the samples (53%) reflected the presence of asbestos containing materials (ACM). Results are presented in Plate 2 (HART, 1990).

Creek Sediments

- Five (5) sediment samples were collected from Glen Cove Creek and two (2) sediment samples and two (2) sediment core samples were collected from Hempstead Harbor. No enhanced levels of radionuclides were detected in the creek or the harbor.

Transformer Characterization

- Thirty eight (38) samples were collected from transformers or other electrical equipment. Eleven (11) samples collected reflected concentrations of PCBs greater than 50 ppm; three (3) units reflected concentrations greater than 500 ppm.
- Although not specified in the AOC, transformer oils were drained from all units; some were disposed of as PCB oils, others as non-PCB oils. The carcasses of three (3) transformers were also disposed of as PCB solids (HART, 1990, p.68).

Mercury Spill Cleanup

- An area inside the Benbow Building (Parcel C) was identified as having mercury on the floor. A commercially available mercury absorbing salt was used to absorb the mercury. Portions of the subfloor conduit which contained mercury could not be cleaned up because heavy equipment that was present made the area inaccessible. The room was boarded up and labelled to indicate the presence of residual mercury.

Additional Tasks Not Specified in AOC

The additional tasks listed below were completed by GCDC and with the concurrence of USEPA either prior to issuance of the AOC or concurrent with the AOC specified tasks listed above. A separate order was issued in April 1989 for the removal of the anhydrous ammonia. In general, these tasks were completed between June 1989 and April 1990.

TABLE 2-2 (continued)
SUMMARY OF INTERIM REMEDIAL ACTIONS AND
ADDITIONAL REMOVAL ACTIONS
Li Tungsten Site
Glen Cove, New York

Pressurized Cylinders

- Twenty-six (26) cylinders were identified for removal. Twenty-four (24) of these cylinders were clearly marked with the name of the owner/distributor. The owners/distributors were contacted and the cylinders were removed.
- Two (2) cylinders remain at the site - their contents are unknown. They were scheduled for sampling and analysis in April 1990. The results of this sampling is not known.

Additional Laboratory Overpacks

- Due to the number of chemicals (over 2500 individual containers; 500 with labels) found in the laboratories, offices, storage spaces in Parcel A, strict adherence to the limitation of the interim remedial action (200 laboratory chemicals) would have left a large quantity of chemicals on-site. Additional chemicals were removed, however, some may still remain

Radioactive Slag Relocation

- Three (3) dump truck loads (approximately 20 cubic yards) of radioactive slag were moved from Parcel A (near the fence at Herb Hill Road and Garvies Point Road) to inside the West Dice Building. The slag was placed on pallets, covered with plastic, and labeled with signs indicating a radioactive hazard.

Anhydrous Ammonia Removal

- One (1) tank of anhydrous ammonia on Parcel A was emptied pursuant to a separate order issued in April 1989. The anhydrous ammonia was removed and returned to its distributor (HART, 1990, p. 69).

Methyl Ethyl Ketone Peroxide (MEKP) Removal

- One (1) pint of MEKP was removed from the refrigerator in the main office building (dark room) for disposal (HART, 1990, p. 70).

Air Sampling

- Inorganic Acid Gases - fluoride was found in excess of one field blank and was thought to be due to hydrofluoric acid found in several drums.
- Volatile Organic Compounds - not detected in significant quantities.
- Inorganics - all samples were significantly below ACGIH published Threshold Limit Values (TLVs). No difference was found between air samples collected inside the buildings and those collected outside.

(e.g., copper wiring and piping) have been removed and general debris (e.g., washing machines, mattresses) have been left behind.

3.0 INITIAL EVALUATION

3.1 REVIEW OF EXISTING DATABASE

3.1.1 Topography and Drainage

Long Island is located in the Atlantic Coastal Plain Physiographic Province, though the predominant morphologic characteristics of the region are glacial rather than coastal origin. The area north of the Li Tungsten site is characterized by headlands which rise abruptly from Long Island Sound to an altitude of about 100 to 150 feet above mean sea level (MSL). Southward, the headlands become increasingly irregular, and are dissected by small streams draining into Hempstead Harbor. Individual hills in this area on the Harbor Hill terminal moraine rise to altitudes above 200 feet.

There are no large streams in the Glen Cove region. Glen Cove Creek, which borders the site to the south, is a saltwater, tidal channel. Surface drainage in the immediate area of the site is generally southward into Glen Cove Creek. Surface water originates on the site as precipitation and as overland flow from adjacent properties. Much of the site is paved or covered with buildings. Runoff is collected in storm drains and routed to outfalls on Glen Cove Creek. A total of 19 drainage outfalls have been identified at the bulkhead along Glen Cove Creek (HART, 1990). The drainage system includes at least one drain in each of Parcels B and C. The remainder of the drains service Parcel A, nearby properties, and storm sewers along Dickson Street, Garvies Point Road and Herb Hill Road. Most of the drains carry water only during and following precipitation events. The location of several of the drainage outfalls were verified during the February 1993 site visit; however, additional observations during the RI will be made to determine which outfalls are still functional.

A pond, approximately 70 feet in diameter, is located in the south-central part of Parcel B. This pond appears to be shallow and supports a thick growth of vegetation along its perimeter. The pond and the disposal area to its north are drained by several small ditches which merge into one intermittent stream. According to old site maps, the stream flows into an underground drain which passes beneath Herb Hill Road and Parcel A, and empties into

Glen Cove Creek. A previously unmapped small intermittent stream/drainage ditch was identified on Parcel C during the February 1993 site visit. This intermittent stream/drainage ditch continues off-site to the south of Parcel C. The intermittent stream/drainage ditch on Parcel C, the stream on Parcel B and the network of storm drains located throughout the site are the only surface water drainages that have been identified on the site. Surface water drainage appears to flow to Glen Cove Creek; no other surface water bodies receive runoff from the Li Tungsten site.

Three surface impoundments are located in the southern part of Parcel C. These include two unlined settling ponds, referred to as Mud Holes, and a lined settling pond known as Mud Pond. The Mud Holes are approximately 30 feet in diameter and were completely dry during the site visits on September 1, 1992 and February 3, 1993. The depth of the sediment in the Mud Hole has not been determined. The Mud Pond is roughly triangular in shape, approximately 150 feet long. A plastic/rubber liner was visible along portions of the upper sidewalls. Standing water was observed during the two site visits. The pond is partly filled with sediment and supports a thick growth of vegetation. Inorganics detected in groundwater samples from adjacent monitoring wells and the presence of stressed vegetation in the vicinity suggest that these impoundments have leached contaminants into the surrounding soils and groundwater (NUS, 1990).

3.12 Climate

Long Island, New York is located between 40° and 42° north latitude in a temperate climate belt. Long Island is characterized by a medium temperature range and mild winters that are moderated by the Atlantic Ocean. The mean annual temperature is 54.7° Fahrenheit. The maximum and minimum mean annual temperatures are 76.8° Fahrenheit (July) and 33.6° Fahrenheit (January) respectively. Precipitation totals are almost the same in the cool season as in the warm season. Most of the precipitation in the area is in the form of rain; only 5 to 10 percent falls as snow or sleet. The mean annual precipitation is 44.22 inches. Monthly averages range from 3.09 inches in February to 5.08 inches in August. The predominant wind flow is from the west-northwest at a mean velocity of 12.4 mph (NOAA, 1974).

3.1.3 Geology

3.1.3.1 Regional Geology

The geology of northwestern Long Island is discussed below with particular emphasis on the Glen Cove region. The Glen Cove region for the purpose of this discussion is defined as the area surrounding the Li Tungsten site for a distance of approximately one mile to the north, east and south, and bounded by Hempstead Harbor to the west. The information was obtained from several United States Geological Survey (USGS) publications (Swarzenski, 1963; Kilburn and Krulikas, 1987; Smolensky et. al., 1989; USGS, 1946).

Long Island is the northern most extension of the Atlantic Coastal Plain. The Island is composed of terrestrial deposits of Cretaceous age and Quaternary deposits primarily of glacial origin (Pleistocene). These deposits form a southeastward thickening wedge of sediments which overlie Paleozoic and Precambrian crystalline bedrock. The bedrock surface and the overlying strata generally dip to the southeast, with the unconsolidated strata thickening in the down-dip direction. In the Glen Cove region, the unconsolidated sediments are 400 to 600 feet thick. The stratigraphic column underlying the northern part of the Town of Oyster Bay, Long Island, which includes the Glen Cove region is presented in Table 3-1.

The Li Tungsten site is located about four miles north of the Harbor Hill terminal moraine, a series of coalescing irregular hills (kames) which form a pronounced ridge trending north-northeast across Long Island. This moraine marks the terminal position of the most recent Pleistocene (late Wisconsin) ice sheet to reach Long Island. The deposits which formed during the glacial recession include outwash sand and gravel deposits, till or ground moraine (a heterogeneous mixture of clay, silt, sand and boulders) interlayered with gray clay lenses and delta deposits. Earlier glacial deposits associated with the Ronkonkoma glaciation underlie the Harbor Hill drift. These deposits are collectively designated as the upper Pleistocene deposits. Older inter-glacial deposits include lacustrine, estuarine and marine sediments.

Table 3-1

**Summary of Geology and Water-Bearing Properties of Deposits
Underlying the Northern Part of Town of Oyster Bay,
Nassau County, New York ***

Series	Geologic Unit	Hydrogeologic Unit	Approximate Range in Thickness (ft)	Character of deposits forming geologic unit *(modified from Swenson, 1943, and Isbister, 1946)	Water Bearing Properties
QUATERNARY					
Holocene	Undifferentiated artificial fill, salt-marsh and swamp deposits, stream alluvium, and shore deposits	Upper Glacial Aquifer	0 to 30	Sand, gravel, silt, and clay; organic mud, peat, loam, and shales. Colors are gray, green, black, and brown.	Permeable zones near the shore and in stream valleys may yield small quantities of fresh or brackish water at shallow depths. Clay and silt beneath the north-shore harbors retard subsurface seawardward and confine underlying aquifers.
Pleistocene	Upper Pleistocene deposits		10 to 300	Till, composed of unsorted clay, sand, gravel, and boulders. Overwash deposits of stratified brown sand and gravel. May also contain some lacustrine and marine deposits consisting of clay, silt, and sand; locally fossiliferous.	Till, relatively impermeable, may cause local conditions of perched water and impede downward permeation of precipitation. Overwash deposits of sand and gravel are highly permeable. Wells screened in glacial overwash deposits yield as much as 1,750 gal/min. Specific capacities of large-capacity wells range from 14 to 175 (gal/min)/ft of drawdown. Water is generally fresh and unmineralized but may locally contain subsurface salt shores.
CRETACEOUS - QUATERNARY					
Upper Cretaceous, Pleistocene, and Holocene	Deposits of Holocene and Pleistocene age, undifferentiated. May locally include eroded remnants of the clay member of the Ramapo Formation	Port Washington Confining Unit	0 to 360	Clay, solid and silty, gray, gray-green, white, red, mottled, and brown, containing lenses or layers of sand or sand and gravel. May locally contain lignite, shales, brecciated, and other microbeds.	Relatively impermeable throughout much of the area. May be moderately to highly permeable in areas adjacent to inferred lens of Magoby aquifer where sand and sand and gravel content may be large. Confines water in underlying Port Washington and Lloyd aquifers but does not prevent movement of water between upper glacial aquifer and Port Washington aquifer. Lenses of sand and sand and gravel provide sources of water with adjacent formations. One large capacity well had a reported yield of 2,000 gal/min with a specific capacity of 43 (gal/min)/ft of drawdown. Coarser deposits may locally contain subsurface salt shores.
	Deposits of Pleistocene age, undifferentiated, and/or local erosion remnants of the Lloyd sand member of the Ramapo Formation	Port Washington Aquifer	0 to 170	Sand, fine to coarse, white, yellow, gray, and brown, or gray and gravel with interbedded clay, silt and sandy clay	Moderately to highly permeable. One large capacity well had a reported yield of 1,300 gal/min with a specific capacity of 11 (gal/min)/ft of drawdown. Water is confined under artesian pressure. Generally contains freshwater but may have high iron content.
CRETACEOUS					
Upper Cretaceous	Mauveaux Group Magoby Formation Undifferentiated	Magoby Aquifer	0 to 610	Clay, silt, sand, and sand, fine to medium, clayey, white, gray, yellow, pink, and multicolored, in lenticular beds. May contain lenticular beds of coarse sand and gravel in lower part of unit. Lignite, pyrite and iron oxide concretions may occur throughout the unit.	Moderately to highly permeable. Wells screened in lower part of aquifer yield as much as 1,400 gal/min. Specific capacities of large capacity wells commonly range from 10 to 30 (gal/min)/ft of drawdown but may be as high as 80 (gal/min)/ft. Aquifer is principal source for public supply. Water is generally of excellent quality. Degree of confinement under artesian pressure is variable; however, artesian conditions increase with depth. Hydraulic conductivity may exist between the Magoby aquifer and adjacent Pleistocene aquifers.
	Clay Member (Ramapo Formation)	Ramapo Clay Confining Unit	0 to 125	Clay, solid and silty, gray, white, red and mottled. May contain brown or layers of fine to medium sand which may locally contain gravel. Sand layers frequently occur near top of unit. Lignite and pyrite are common.	Relatively impermeable. Confines water in underlying Lloyd aquifer but does not prevent movement of water between Magoby and Lloyd aquifers.
	Lloyd Sand Member (Ramapo Formation)	Lloyd Aquifer	0 to 195	Sand, fine to coarse, white, yellow, or gray, and gravel, commonly in a clayey matrix. Contains brown and layers of solid or silty clay. Beds are usually lenticular and frequently show great lateral changes in composition.	Moderately permeable. Large-capacity wells may yield as much as 1,600 gal/min; specific capacities commonly range from 10 to 19 (gal/min)/ft of drawdown. Water is confined under artesian pressure; some wells flow. Water is generally of excellent quality but may have high iron content.
	Crystalline Rocks	Bedrock	Not Known	Metamorphic and igneous rocks; predominantly gneiss, quartz, and granite. May have weathered zone at top.	Relatively impermeable. Contains some water in fractures but impracticable to develop owing to low permeability.

The predominant surficial deposit in the Glen Cove region is a veneer of Harbor Hill ground moraine, which is a heterogeneous mixture of clay, silt, sand and boulders typically 5 to 10 feet thick although locally, the thickness is as much as 40 feet. Beneath the ground moraine lies another sequence of older (Ronkonkoma) drift containing interlayered glacial till and outwash deposits. The glacial sediments range in thickness from less than 10 to over 200 feet in the northern part of Long Island (Kilburn and Krulikas, 1987).

On most of Long Island, the glacial deposits lie unconformably on the Mattawan Group Magothy Formation - Undifferentiated (Magothy Formation), a Cretaceous age sedimentary sequence of sand, gravel and discontinuous clay lenses. In the Glen Cove region, however, the Magothy Formation is missing. The absence of the Magothy is attributed to channel cutting during a pre-Wisconsin stage of the Pleistocene epoch (Smolensky et al, 1989). Post Cretaceous erosion was the major contributing factor in producing more than 400 feet of relief on the Cretaceous surface along the north shore of Long Island.

In the Glen Cove region, where the Magothy Formation is missing, the upper Pleistocene deposits are underlain by an extensive unit comprised of clay, silt and a few layers of sand. This unit is believed by some researchers to be equivalent to the Gardiners Clay, which is a shallow marine sequence deposited during an interglacial period (Swarzenski, 1963; Isbister, 1966). A more recent publication (Kilburn, 1972) refers to this stratum as the Port Washington confining unit and identifies it as Pleistocene and Holocene age.

In the Glen Cove region, that sequence rests unconformably on the unnamed clay member of the Raritan Formation. The surface of the clay member is about 200 feet below sea level (Smolensky et al, 1989). The clay member and the Pleistocene age clay deposits are in direct contact and differentiation between the two is sometimes difficult (Smolensky et al, 1989). Together these strata comprise a contiguous unit approximately 75 feet thick in the Glen Cove region.

The lower unit of the Raritan Formation is the Lloyd Sand Member which is approximately 125 feet thick in the Glen Cove region. The Lloyd Sand Member rests on bedrock at depths of approximately 400 to 500 feet below MSL (Smolensky et al, 1989).

A geologic log of a water supply well (N1917) drilled on site for Wah Chang Trading Corporation provides the only information on the deep subsurface geology in the region (or on the site) (Table 3-2). The well was drilled in 1943, probably by the cable tool method, and the geologic samples were examined, described and logged by the USGS. The well was drilled to a depth of 311 feet and terminated in the Lloyd Sand Member. Well N1917 is reportedly located on Parcel A, 150 feet south of the centerline of Herb Hill Road and 75 feet west of the centerline of Garvies Point Road as shown on Figure 2-3. It has not been determined if this well still exists.

3.1.3.2 Site Geology

The principal source of information on the site geology was obtained from a single hydrogeologic investigation of the Li Tungsten site (G&M, 1988). An RI/FS at the Mattiace Petrochemical site (EBASCO, 1991) which lies just west of the Li Tungsten site (Figure 2-3), provided additional information in assessing the site geology.

A total of 23 borings have been drilled on the site. Detailed logs are available for 16 of these borings and indicate unsorted deposits of sand, silt, clay and gravel interbedded with lenses of moderately-to-well sorted sand, silt and clay. This lithology is consistent with published sources that describe the site area as underlain by interlayered Pleistocene deposits of till, outwash and lacustrine sediments (Swarzenski, 1963; Kilburn and Krulikas, 1987).

The monitoring wells that have been installed on the site were used primarily for assessing shallow groundwater quality. Only three wells were drilled to a depth greater than 20 feet, and only one well to more than 25 feet. As a result, except for the USGS log of supply well N1917, little information is available on the deeper site geology. Some inferences can be made based on the regional geology and information obtained from nearby studies. According to Smolensky et. al., (1989), the Magothy Formation is missing and the clay member of the Raritan formation and/or the Port Washington confining unit directly underlies the Upper Pleistocene deposits in the area of the Li Tungsten site. The top of this clay layer rises uniformly from more than 100 feet below MSL beneath Glen Cove Creek to about 50 feet above MSL on the site. However, the scale of Smolensky's maps is

TABLE 3-2
GEOLOGIC LOG OF WATER SUPPLY WELL N1917
WAH CHANG TRADING CORPORATION
GLEN COVE, NEW YORK

	Thickness (feet)	Depth (feet)
Fill	2	2
Gravel, sand, and clay, brownish-gray	6	8
Clay, gray, plastic, with pebbles	49	57
Gravel, light yellow, clean	14	71
Sand, coarse, and gravel, light yellow, clean	2	73
Gravel, silt, sand and clay	22	95
Gravel, fine and coarse sand	8	103
Clay, gray	47	150
Clay, gray, with some gravel	15	165
Silt, almost a sand, clean, light brick red	25	190
Clay, dark gray, plastic, very little silt	25	215
Sand, fine, and silt, light gray	77	292
Sand, medium to fine, white, some clay	3	295
Sand, coarse, and gravel, white, clean	16	311
Casing: 8 inch to 6 inch.		
Screen: 10 feet of 6 inch. with bottom at 306 feet.		

NOTES:

1. Supply Well N1917. Wah Chang Trading Corp., 63 Herb Hill Road, Glen Cove (6 E, 1.8 N, 2.9 W). Drilled by C. W. Lauman and Company, Inc., May 1943. Altitude about 10 feet above sea level. Log begins at land surface. Log based on examination of samples by W. deLaguna.
2. NYSDEC Water Power and Control Commission, Record of Wells in Nassau County, New York, Supplement 1. Prepared by the USGS in cooperation with the Water Power and Control Commission, and the Nassau County Department of Public Works. Bulletin GW-10, Albany, 1946, page 145.

too large to accurately assess subsurface conditions on the site. The log of supply well N1917 shows a sequence of clay beds from 8 to 57 feet and from 103 to 215 feet below land surface. The deeper clay may be the clay member of the Raritan Formation. The deeper clay, however, cannot be differentiated with any confidence from the younger Port Washington confining unit from the descriptions in the log.

A detailed contour map of the Cretaceous clay surface was prepared for the Mattiace site (EBASCO, 1991). This map shows that the upper surface of the clay varies dramatically in elevation over a short distance. The clay surface was found to have over 65 feet of relief across a 350 foot horizontal transect of the site. Moreover, this slope of nearly 20 percent is downward to the northwest, which is opposite in direction to the regional trend as mapped by Swarzenski (1963). The clay surface and the abundance of non-horizontal beds observed in the clay was attributed to deformation by the moving ice sheet (EBASCO, 1991).

3.1.4 Hydrogeology

3.1.4.1 Regional Hydrogeology

There are two discrete aquifers in the Glen Cove region. These are designated as the Upper Glacial and the Lloyd aquifers. In addition to these aquifers, local bodies of perched groundwater occur above the water table. Nassau and Suffolk Counties were declared a sole source aquifer by USEPA on June 29, 1978.

Bodies of perched groundwater are found in several parts of the Glen Cove region. Perched groundwater occurs where the downward migration of water in the vadose zone is impeded by a layer of relatively low permeability which results in a local zone of saturation above and unrelated to the main water table. In the Glen Cove region, perched water occurs close to the land surface in depressions that are underlain by clayey till and clay. Perched groundwater is prevalent in the area of ground moraine north of the Harbor Hill terminal moraine (which includes the Glen Cove region).

The Upper Glacial aquifer consists of permeable upper Pleistocene deposits that occur

below the water table. The water table occurs from MSL to about 60 feet above MSL in the Glen Cove region. Recharge is entirely from precipitation occurring mostly during the late fall and winter when plant growth is dormant. Under natural conditions, shallow groundwater discharges to streams, springs and Long Island Sound and its harbors by evapotranspiration and by downward leakage to the underlying aquifer. Previous investigations have indicated that groundwater movement in the Upper Glacial aquifer is generally to the south in the vicinity of the site, with shallow discharge to Glen Cove Creek. Groundwater movement in the deeper aquifers may pass under the creek. In the Glen Cove region, discontinuous beds of low permeability sediments limit the amount of water which can be pumped from the Upper Glacial aquifer and several wells tap the deeper Lloyd aquifer.

The Magothy aquifer is not present in the Glen Cove region. However, groundwater undoubtedly moves into the Upper Glacial aquifer where it is in contact with the subcrop of the Magothy formation to the west and south.

The clay member of the Raritan Formation is a confining unit that overlies the Lloyd aquifer. The Port Washington confining unit occurs above, and is contiguous with, the clay member in many places. Together, these strata form an effective confining unit separating the Lloyd aquifer from the Upper Glacial aquifer in the Glen Cove region. The thickness of the confining unit is about 112 feet at the Li Tungsten site based on the log of well N1917. In places where the Cretaceous deposits have been completely eroded, the Port Washington confining unit lies on a sequence of deposits of Pleistocene and (or) Late Cretaceous Age called the Port Washington aquifer. It is not known if the Port Washington aquifer extends onto the site.

The lower limit of the Lloyd aquifer and the Port Washington aquifer is the Precambrian bedrock surface; the upper limit is the clay member of the Raritan formation or the Port Washington confining unit. The Lloyd aquifer is the most confined of the water bearing units, as demonstrated by minimal interference effects between pumping wells tapping the different aquifers. Hydraulic heads in the Lloyd aquifer are generally lower than those in the Upper Glacial aquifer resulting in downward leakage of water through the clay unit. The Lloyd aquifer is replenished entirely by downward percolation of water from the

overlying aquifers through the more permeable zones of the confining unit and, directly but slowly, through the clay itself. The primary recharge area of the Lloyd aquifer is in eastern Nassau County. Groundwater movement in the Lloyd aquifer is generally westward, away from the recharge area. Groundwater moves laterally into the Port Washington aquifer from the Lloyd aquifer where the two units are contiguous. Water discharges by submarine leakage and through pumping wells.

3.1.4.2 Site Hydrogeology

The uppermost hydrostratigraphic unit on the site is the Upper Glacial aquifer comprised of outwash and lacustrine deposits of Quaternary Age. Immediately beneath this aquifer lies a areally continuous clay sequence. Data from the Mattiace RI indicate that this clay represents both the clay member of the Raritan Formation and the younger Port Washington confining unit. This clay impedes downward groundwater movement, thereby inhibiting contaminant migration from the Upper Glacial aquifer to the underlying Lloyd aquifer. For this reason, hydrogeologic investigations of industrial sites in the area, including the Li Tungsten site, have focused almost exclusively on shallow groundwater in the Upper Glacial aquifer. Consequently, little information is available on the deeper glacial sediments and Cretaceous strata (Raritan Formation) at the site. It should be noted that water supply well N1917 is not currently in use; however, it may not have been properly abandoned (grouted). If the casing leaks or if the well head is intermittently flooded, the well could serve as a potential conduit for contaminants to reach the Lloyd aquifer.

Groundwater elevation data collected on the site indicate the presence of a steep hydraulic gradient in the Upper Glacial aquifer. High hydraulic heads in the northern portion of the site and low heads in the southern portion suggest that groundwater flow is generally from north to south across the site with groundwater discharge to Glen Cove Creek. The relatively high hydraulic heads in the northern portion of the site and in several wells in the southern portion of the site are a consequence of perched groundwater in these areas (G&M, 1988). This interpretation is consistent with the USGS description of the regional hydrogeology (Swarzenski, 1963; Kilburn and Krulik, 1987). The site geologic information from previous well logs, however, does not appear to support this assessment as the areas of high hydraulic head do not correlate with low permeability layers (e.g., silt or clay lenses).

One reason for this discrepancy might be that when the borings were drilled on the site, soil sampling was intermittent rather than continuous and changes in lithology may not have been recognized. Another possibility is that because the wells were installed in the uppermost groundwater zone, low permeability materials occurring below the boring completion depths were undetected. A more complete geological characterization of the deeper glacial materials is needed to determine whether the large hydraulic head differences are due to perched groundwater or some other factor, and to determine the effects the different strata have on groundwater flow direction and velocity.

As described earlier, the upper surface of the clay confining unit changes in elevation over a short distance beneath the Mattiace site (EBASCO, 1991). Furthermore, the water table configuration, as mapped, appears to strongly reflect the topography of the clay surface. For example, a groundwater divide coincided with the top of a broad mound mapped on the clay surface. The RI Report concluded that the clay topography "has a dominant effect on local groundwater hydrology" in the Upper Glacial aquifer. A similar effect may occur on the Li Tungsten site, and the high water table heads may correspond to high elevations of the underlying clay, though no site-specific information is currently available to support this conclusion.

3.1.5 Population and Environmental Resources

Population, Land Use and Zoning - Glen Cove is located on the north shore of Long Island, in a suburban area with an economically and ethnically mixed population. As of 1990, Glen Cove's population totaled 24,149 (U.S. Dept. of Commerce, 1990). Glen Cove's population includes white (86%), black (8%), Asian (3%), Hispanic and other racial and ethnic groups (3%) represented. Approximately 4% of the residents are children under the age of three, and 17% are senior citizens over the age of 64 (U.S. Dept. of Commerce, 1990). Glen Cove's economic base ranges from very wealthy to very poor, with a substantial middle class (EBASCO, 1991).

The area within a 1.5 mile radius of the site contains a community hospital, eight schools, 11 municipal parks, as well as Garvies Point Preserve. Seven of these parks and one school are in Sea Cliff, the others are found in Glen Cove (EBASCO, 1991). The area that

surrounds the Li Tungsten site is predominantly industrial. The site is located in an area zoned as I-2, Light Industrial District (the area west of Dickson Lane which lies north of Herb Hill Road) and I-3, Industrial District (the areas east of Dickson Lane and south of Herb Hill Road). The surrounding areas consist of both industrial and residential zoning districts, the closest residential areas falling into the R-1, R-3 and R-4 districts. R-1 zoning consists of one acre residences, R-3 zoning consists of quarter acre residences and R-4 zoning is comprised of 6,500 - 7,500 square foot, one and two family residences.

Environmental Resources - The site consists mostly of buildings and structures, with associated paved areas and dirt roads. There are, however, several vegetated areas on-site, and several surface impoundments. Vegetated areas include the northwest corner of Parcel C including the area to the north of the Reduction (Benbow) Building; the area surrounding the Mud Pond/Mud Holes in the southwest portion of Parcel C; and Parcel B. Scarred vegetation was found observed in the area north of the Reduction Building and in the vicinity of the Mud Pond/Mud Holes on Parcel C.

The surface impoundments on the site include: two unlined settling ponds, referred to as Mud Holes; a lined settling pond known as the Mud Pond; and three concrete oil recovery sumps. The Mud Pond/Mud Holes are located immediately south and southeast of the 500,000-gallon fuel oil tank along Garvies Point Road. The three concrete oil recovery sumps are located west of the Dice/Warehouse Building and are connected via pipes to the Mud Pond/Mud Holes. The total area of these impoundments is estimated to be 11,760 square feet (NUS, 1990).

The nearest downslope surface water is Glen Cove Creek, which generally flows southwesterly into Hempstead Harbor, but is also affected by the tides. The creek is adjacent to the site's southern boundary and receives runoff from the site and from drainage pipes on Herb Hill Road. Glen Cove Creek is tidally influenced along its entire 0.75 mile length and ranges from approximately 30 feet wide upstream to approximately 1000 feet wide at its mouth. There are limited biological resources present in the creek, known species include barnacles, bluefish and blue crab (EBASCO, 1991).

Although no critical habitats of federally listed endangered species have been identified in

the vicinity of the site, Hempstead Harbor is a known waterfowl wintering area most noted for scaup, canvasback and black ducks, and is a nursery/feeding habitat for shrimp, striped bass, bluefish, Atlantic silverside, menhaden, winter flounder and blackfish. The Harbor has been designated as a "significant coastal fish and wildlife habitat" by the New York Department of State under Policy 7 of the Waterfront Revitalization and Coastal Resources Act of 1981.

The state water quality classification for Hempstead Harbor north of Bar Beach is Class SA (suitable for shellfishing for market purposes and primary/secondary recreation). The state water quality classification for Glen Cove Creek is Class 1 (secondary contact recreation except for primary recreation and shellfishing). The waters of Long Island Sound, including Hempstead Harbor and Glen Cove Creek, have been closed to shellfish harvesting for the last 20 years because of high concentrations of fecal coliform bacteria.

Although no freshwater wetlands greater than 5 acres in area have been identified within 2 miles downstream of the Li Tungsten site (NUS, 1990), the possibility exists for the presence of smaller wetlands within the site's boundaries, especially in the area of the Mud Pond/Mud Holes, Parcel B, the vegetated area in the northwest corner of Parcel C and Parcel C'.

Another environmental resource in the vicinity of the site is Garvies Point Preserve, located west of the site along the shoreline of Hempstead Harbor and extending inland north of Glen Cove Creek. The preserve is characterized as a mixed deciduous forest which steeply slopes to a wide sandy beach on its western perimeter (EBASCO, 1991). The deciduous forest supports a wide variety of bird species, both migrant and resident, and small mammals such as the eastern cottontail, gray squirrel and striped skunk.

3.1.6 Characteristics of Radiological Contamination

A survey of radioactive materials and radiation exposure rates was performed for the GCDC in 1989. The report (NDL, 1989) is included as an Appendix to the Interim Remedial Actions Report (HART, 1990). The investigation included a gridded surface emission rate survey, surface alpha particle survey of equipment and miscellaneous debris,

limited indoor radon and thoron measurements, and uranium and thorium series radionuclide characterization of groundwater, pond sediment, ore, processed materials, and soils. These data are also discussed in Section 5.3.6 by measurement type.

As a result of the tungsten refining process, ore containing low levels (e.g., 10-20 pCi/g) of natural thorium and uranium were concentrated in the various processed materials, which are in the form of rocks, granular material, and soil. Radionuclide concentrations in the materials currently on site range from the tens of pCi/g to approximately 1000 Pci/g. Ambient radiation exposure rates on the site typically range from 10-30 μ R/h; however, emission rates up to 1 mR/h have been measured along the surface of some of the waste piles.

Some radioactive materials were removed from the site or moved indoors (Dice Building) (HART, 1990). In general, these materials were among the most highly contaminated materials discovered during the 1989 radiological survey. In addition to the piles of process materials and ore currently present at the site, four areas with thorium contamination remain. These are a heavily vegetated area in Parcel C with exposure rates from 3-5 mR/h, a pile of rocks on the north end of Parcel C with exposure rates from 1-3 mR/h, a pile of rocks on the northern perimeter of Parcel A with exposure rates from 1-3 mR/h, and an area along the Parcel A north fence where buried waste results in an exposure rate of 300 μ R/h. With the exception of some tanks, site structures and building components/equipment (e.g., floors, walls, etc.) did not indicate contamination with radionuclides.

The potential for exposure to the public was determined to be low (NDL, 1989). There are two areas along Herb Hill Road (north of Parcel A) where the exposure rates are elevated (100-300 μ R/h) above the natural background rate (8-10 μ R/h). However, the levels drop off to background within a few feet of the fence. In addition, the Nassau County Department of Health (NCDOH) and the New York State Department of Health (NYSDOH) took soil samples from seven locations along the site perimeter in June, 1989, for analysis of thorium, radium, and uranium. They did not find any elevated radionuclide concentrations and concluded it unlikely that radionuclides are migrating from the site. In November, 1989, fish, clam, and sediment samples were collected and were also found not

to contain elevated radionuclide concentrations.

3.1.7 Characteristics of Chemical Contamination

Characteristics of chemical contamination on the site stem from activities associated with the production of tungsten carbide powder, tungsten wire and welding rods. To produce these products, monazite sand and tungsten ore or concentrates were smelted between the 1942 and 1985. The treatment processes used to extract tungsten metal from these materials generated a residual slag (waste ore) which tended to concentrate radioactive isotopes of uranium, thorium and radium, and other heavy metal impurities. The slag, as well as some processed and unprocessed, ore was stored on-site in wooden crates, piles, and drums. Much of this material still remains on the site and some of it is believed to have been disposed of on site (Parcels B and C).

Potential contaminants on the site include commercially prepared strong acids, strong bases, organic solvents, aqueous ammonia, mercury and cyanide which were used in the treatment processes. The acids were used for leaching of impurities out of the tungsten where mechanical separation was not effective. An on-site laboratory also existed where the tungsten product was analyzed for impurities and either sent for reprocessing or identified as a finished product. The majority of chemicals used in the laboratory were removed as part of the interim remedial actions (HART, 1990). Other organics used on the site included PCBs in transformers, and fuel oil which was stored in several tanks, including one 500,000 gallon aboveground storage tank.

Asbestos containing materials (ACM) has been found on-site in siding shingles, roof tiles, tank covers and pipe insulation. ACM has also been found on the ground at the site.

3.1.8 Sources and Distribution of Contamination

As described earlier, several investigations have been completed at the site (RTP, 1988; G&M, 1988; NDL, 1989; HART, 1990; NUS, 1989; 1990). The results of these investigations were used to prepare the following sections which summarize the current understanding of environmental conditions at the site.

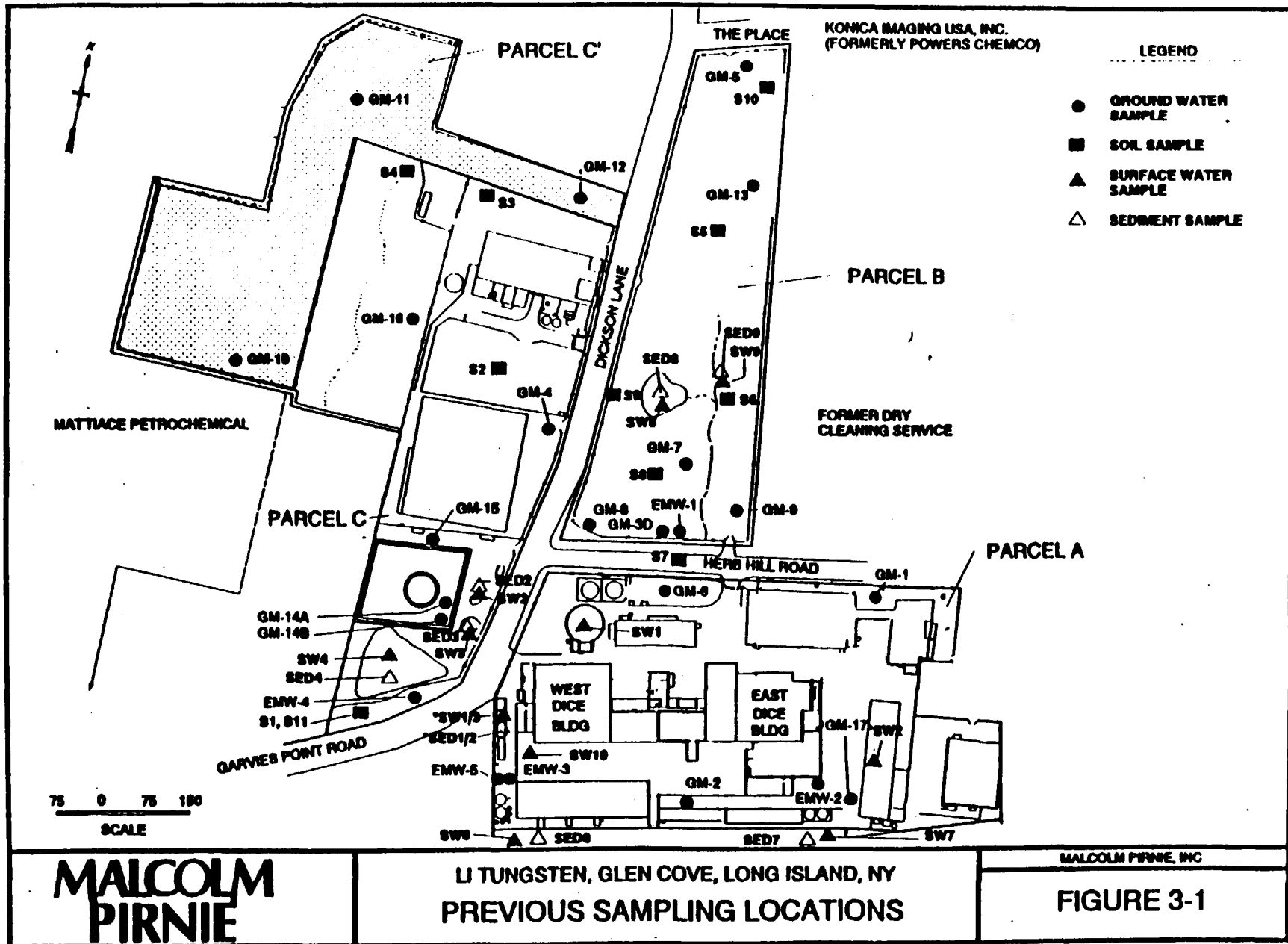
The primary sources of contamination on the site include processed and partially processed tungsten ore present in drums, wooden crates, and piles located both inside and outside the buildings. Removal of these source materials is proposed in this Work Plan as an interim remedial action prior to initiating the RI field investigation. Other potential sources include; Mud Pond and two Mud Holes which were used for disposal of wastewater; the disposal area located on Parcel B; unconfirmed disposal areas on Parcel C that is devoid of vegetation; underground storage tanks (whose locations and contents are unknown), and a 500,000 gallon aboveground fuel oil tank.

Secondary sources of contamination include the on-site soil; off-site groundwater from the Mattiace property, the former Powers-Chemco property and/or a former dry cleaner; and the storm and process drains on-site and off-site. Removal of asbestos is also proposed in this Work Plan as an interim remedial action prior to initiating RI field investigation (See Section 3.7).

Chemical contamination is distributed throughout the groundwater, surface water, soils and sediments at the site. Volatile organic compounds in the groundwater may originate from off-site sources, including a former dry cleaning establishment to the east of Parcel B and the Mattiace site (NUS, 1990). No on-site source of organic contaminants has been identified. The predominant contamination attributable to on-site sources is inorganic metals. Inorganic metals are found at the majority of the groundwater sampling locations. Inorganic metals have been identified in the on-site surface water and sediment contamination, including Mud Pond, the Mud Holes, the pond and associated drainage stream on Parcel B, the standing water in the building, and open tanks.

3.1.8.1 Chemical Characteristics of Soil

This section presents a summary of the chemical characterizations of the soils based on existing data (NUS, 1990). Soil samples were collected at a total of 10 locations (S-1 through S-10) as shown on Figure 3-1. The samples were analyzed for volatile and semi-volatile organic compounds, pesticides/PCBs, and inorganic compounds (metals and non-metals).



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No volatile organic compounds were detected in any of the soil samples. Semi-volatile compounds were identified at two of the soil sample locations, S-3 and S-9. Only one semi-volatile compound, Di-n-butylphthalate, was detected in Sample S-3 at a concentration of 690 $\mu\text{g}/\text{Kg}$. Soil sample S-3 was taken from the area of a waste pile located at the northern portion of Parcel C. Sample S-9 showed a total semi-volatile concentration of 4,820 $\mu\text{g}/\text{Kg}$. Sample S-9 was taken from Parcel B adjacent to Dickson Lane. Semi-volatile sample results are summarized in Table 3-3.

Low concentrations of pesticides and PCBs were identified at 6 of the 10 sample locations. Total pesticide concentrations of 94 $\mu\text{g}/\text{Kg}$ and 71 $\mu\text{g}/\text{Kg}$ were found in samples S-1 and S-6, respectively. Samples S-5, S-7, S-9 and S-10 had total PCB concentrations of 540 $\mu\text{g}/\text{Kg}$, 640 $\mu\text{g}/\text{Kg}$, 7,600 $\mu\text{g}/\text{Kg}$ and 690 $\mu\text{g}/\text{Kg}$, respectively. The source of the PCB contamination is likely to have originated from the 38 transformers that were located throughout the site. All of these transformers were drained as part of the interim remedial actions and the PCB oils were disposed of as hazardous wastes (HART, 1990). Pesticide/PCB sample results are summarized in Table 3-4.

Inorganics were identified in all 10 of the soil samples. The inorganic analysis indicate that there are relatively high concentrations of heavy metals (aluminum, antimony, arsenic, cadmium, chromium, cobalt, copper, iron, mercury, and lead) in the soils. The soil samples appeared to be collected in areas associated with waste disposal, (e.g., waste piles, disposal area in Parcel B, and in areas of stained soil). Inorganic sample results are summarized in Table 3-5.

A soil gas survey was conducted on the site in April 1988 (G&M, 1988). A total of 36 samples were collected to determine if VOCs were present in the soils. The survey focused on the unpaved areas of Parcel B and Parcel C. A Photovac Gas Chromatograph (GC) was calibrated for three specific compounds; 1,2-dichloroethene, trichloroethylene and tetrachloroethene. Only two of the 36 sample locations indicated the presence of VOC contamination. These samples were located north of Herb Hill Road along the southeastern boundary of Parcel B. The survey concluded that the general lack of VOCs in the soil suggests that the VOCs detected in the groundwater originate from off-site sources. One such off-site source is a former dry cleaner located adjacent to the southeastern boundary

TABLE 3-3
SEMI-VOLATILE ORGANIC ANALYSIS, SOIL SAMPLES
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Sample Number	S-1	S-2	S-3	S-5	S-6	S-7	S-8	S-9	S-10
Date	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90
Compound									
Benzoic acid		J	J					J	J
1,2,4-Trichlorobenzene				J					
Napthalene						J			
Acenaphthene						J			
Dibenzofuran						J			
Fluorene						J			
Phenanthrene				J	J	890		J	J
Anthracene						J		J	
Di-n-butylphthalate		J	690						J
Fluoranthene	J			J	J	990		610	J
Pyrene				J	J	950		630	J
Butylbenzylphthalate						J			J
Benzo(a)anthracene					J	560		410	J
Chrysene				J	J	540		390	J
bis(2-Ethylhexyl)phthalate	J	J	J	J	J	J	J		J
Benzo(b)fluoranthene	JN	JN		JN	JN	930EN		980EN	JN
Benzo(k)fluoranthene	JN	JN		JN	JN	930EN		980EN	JN
Benzo(a)pyrene				J	J	420		440	J
Indeno(1,2,3-cd)pyrene					J	J		J	J
Dibenz(a,h)anthracene						J		J	
Benzo(g,h,i)perylene					J	J		380	J

NOTES: All results are from NUS Corporation report, 1990.

E= Estimated value.

J=Estimated value, compound present below CRQL but above IDL.

N=Presumptive evidence of the presence of the material.

All concentrations are in micrograms per kilogram (ug/kg).

TABLE 3-4
PESTICIDE DATA ANALYSIS, SOILS
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Sample Number	S-1	S-3	S-5	S-6	S-7	S-8	S-9	S-10	S-11#
Date	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90
Compound									
alpha-BHC		R							
beta-BHC		R							
delta-BHC		R							
gamma-BHC (Lindane)		R							
Heptachlor		R							
Aldrin		R							
Heptachlor epoxide		R							
Endosulfan I		R							
4,4-DDE	34								
4,4-DDT	60			71					57
Aroclor 1248							4700		
Aroclor 1254			540		640		2900	690	

NOTES: All results are in micrograms per Kilogram ($\mu\text{g/Kg}$)

#= Sample S-11# is a duplicate of sample S-1.

R=Analysis did not pass EPA QA/QC.

TABLE 3-5
INORGANIC ANALYSIS DATA, SOIL SAMPLES
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Sample Number	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
Date	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90
Inorganic Compound										
Aluminum	6150	323000E	330	519	16300	2710	8750	9840	4960	11200
Antimony	258E	272E	796E	188E	310E	458E	17.7		296E	
Arsenic	309	2600E	3370	3700	437	452	44.1	33	233	10.5
Barium	J	492E	J	J	860	83.1	66.9	109	177	95.2
Beryllium	J	8.9E			2	J	J	J	J	J
Cadmium	J	49E	14.9	16	16.5	17.4	2	1.4	9.1	1.7
Calcium	J	59200E	J	J	36800	4770	14700	J	2200	4580
Chromium	14.3	172E		39.1	1600	13.3	19.3	24.2	20.5	23.6
Cobalt	J	198E	J	J	2270	J	21.4	J	73.5	16
Copper	46.2E	3080E	2190E	752E	4180E	1030E	172E	317E	1150E	42.1E
Iron	28500	172000E	327000	246000	85900	48700	14700	60200	60100	17200
Lead	179	16000E	9090	1960	3390	14200	324	58	8660	240
Magnesium	J	2470E	J	J	48900	J	8950	1230	1540	2130
Manganese	87.3	25100E	2260	5290	18400	154	403	340	2120	760
Mercury	0.54E	13E	0.68E	0.6E	1.7E	0.9E	1.1E		1.4E	0.36E
Nickel	J	53.9E			9130	J	29.5	9.8	165	25.4
Potassium	J	J	J	J	J	J	J	J	J	J
Selenium			2.5E	3.4E	1.9E	13.6E			10E	
Silver	4.8	65.5E	156	84.3	75.6	125	2.6		55.5	
Sodium			8540		44.0					
Thallium	R	R	R	R	R	R	R	R	R	R
Vanadium	20.8E	117E	J	J	43.3E	39.5E	32.4E	39.2E	22.7E	50.4E
Zinc	43.3E	2980E	1330E	1240E	1570E	847E	166E	52.6E	559	179E
Cyanide		1.5E								

NOTES: All results are from the NUS Corporation Report, 1990.

All results are in micrograms per kilogram (ug/kg)

E = Estimated value

J = Compound present below CRQL but above IDL

R = Analysis did not pass EPA QA/QC.

Blank space = Compound analyzed for but not detected.

of Parcel B.

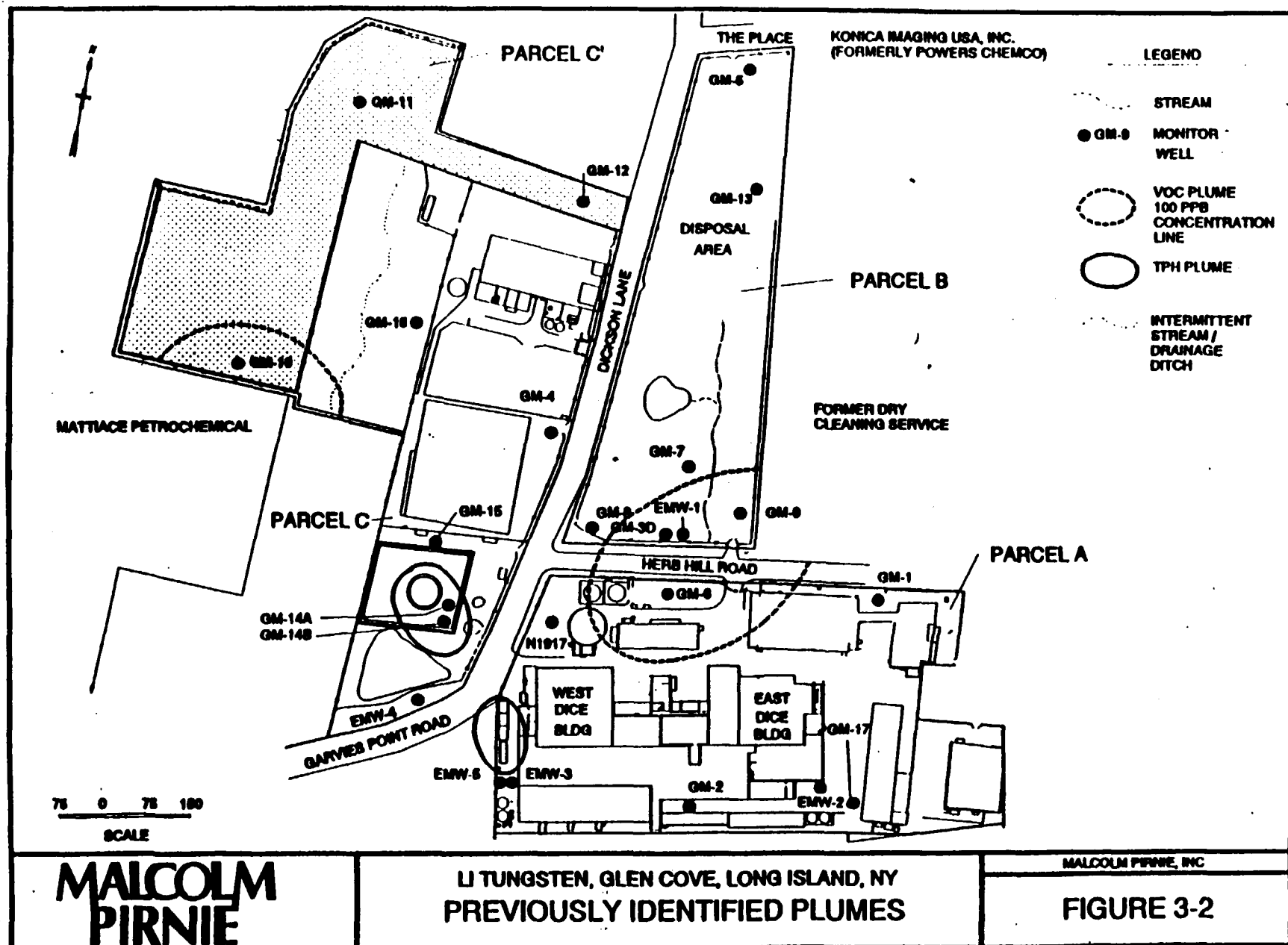
3.1.8.2 Chemical Characteristics of On-Site Groundwater

The groundwater quality on the site has been sampled in two previous investigations; (G&M, 1988, NUS, 1990). These investigations characterized the contamination of the shallow (glacial) groundwater. To assess groundwater chemistry, water samples were obtained from 21 monitoring wells in 1988 (G&M, 1988). These samples were analyzed for inorganic constituents (metals and nonmetals) and volatile organic compounds. Additional groundwater samples were collected from nine wells (NUS, 1990) and analyzed for inorganics, volatile and semi-volatile organic compounds, and pesticides/PCBs. The analytical results (compounds detected) from the two investigations are discussed below. In general, the results of the two sampling episodes are similar.

Organics

Concentrations of VOCs were detected in the shallow groundwater at five locations (Figure 3-2). Analytical results for VOCs was summarized in Table 3-6. A plume of VOCs was previously identified in the southern part of Parcel B (wells EMW-1, GM-3D, GM-8, and GM-9). This plume extended into the northern part of Parcel A (wells GM-1 and GM-6). The contaminants detected in the highest concentrations were tetrachloroethene, trichloroethene and 1,2-dichloroethene. The source of these contaminants is unknown, but may be originating from an off-site source. Other VOCs detected in samples from these wells include vinyl chloride, 1,1-dichloroethene, trans-1,2-dichloroethene, 1,2 dichloroethane, 1,1,1-trichloroethane, trichloroethylene and benzene.

The second area of VOC contamination in the shallow groundwater was detected in Parcel C' (Figure 3-2). Total VOCs (360 $\mu\text{g/L}$) were detected in well GM-10 in the southern part of this parcel. The compound occurring in the highest concentration in the sample from well GM-10 is 1,1,1-trichloroethene (200 $\mu\text{g/L}$). Tetrachloroethene, trichloroethylene, 1,2-dichloroethene, 1,1-dichloroethene and 1,1-dichloroethane were also detected in this well. The extent and source of the groundwater contamination in Parcel C' may originate from an off-site source as discussed below in Section 3.1.8.3.



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TABLE 3-6
VOLATILE ORGANIC ANALYSIS DATA, GROUND WATER
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Well Number	GM-1	GM-3D		GM-6	GM-8	GM-9	GM-10		GM-13	GM-14A		EMW-1	EMW-3		EMW-4	EMW-5
Date	04/07/88	04/08/88	04/19/90	04/07/88	04/08/88	04/08/88	04/15/88	04/19/90	04/15/88	04/15/88	04/19/90	04/08/88	04/08/88	04/19/90	04/08/88	04/08/88
Compound																
Acetone											600					
Vinyl Chloride		36		12		32						52	2			
Chloroethane				1												
1,1-Dichloroethene		3					11	J				6				
1,1-Dichloroethane							4	J								
trans-1,2 Dichloroethene (total)			110					87								
Chloroform													J			
1,2-Dichloroethene	4	860		430	7	220	66		13			2100				
1,2-Dichloroethane	5															
2-Butanone											84					
1,1,1-Trichloroethane						2	200	450								
Trichloroethylene	5	710	130	780	5	140	58	93	5			1600	1	5		
cis-1,3-Dichloropropene																
Benzene		2										6	9		1	1
Tetrachloroethene	16	7400	1100	1800	66	1600	30					16000				
Ethylbenzene										3						

NOTES: 1988 results are from the Gorrughty & Miller report (1988); 1990 results are from the NUS Corporation report (1990).

J = Compound present below CRQL but above IDL.

Blank Space = Compound analyzed for but not detected.

All concentrations are in micrograms per liter (ug/L).

The third area of VOC contamination in the shallow groundwater near the fuel oil impoundment in Parcel C. Groundwater samples collected in well GM-14A reflected the presence of ethylbenzene (3 µg/L) (G&M, 1988) 2-butanone (84 µg/L) and acetone (600 µg/L) (NUS, 1990). The source of these compounds is unknown, however, 2-butanone and acetone are two common laboratory contaminants.

A fourth area of VOC contamination occurs at well EMW-3. The total VOC concentration in a groundwater sample from this well was very low (12 µg/L), and consisted of vinyl chloride (2 µg/L), trichloroethylene (1 µg/L) and benzene (9 µg/L), (G&M, 1988). This well was resampled in 1990 and only trichloroethylene (5 µg/L) was detected (NUS, 1990). This well is located downgradient of former fuel oil tanks and the wastewater treatment plant.

VOCs were not detected in wells located in the northern part of the site, except in well GM-13. In that well, the total VOC concentration was 18 µg/L consisting of 1,2-dichloroethene (13 µg/L) and trichloroethylene (5 µg/L). Well GM-13 was installed in the disposal area (Parcel B) where drummed waste is thought to have been disposed.

VOCs were either not detected or were detected below ARARs, in the remaining on-site wells. Semi-volatile analytical data from two wells (EMW-4 and GM-3D) did not pass USEPA QA/QC validation procedures, however, semi-volatile organic compounds were not detected in any of the other wells sampled.

Inorganics: Metals

Elevated concentrations of lead, cadmium, tungsten, chromium, arsenic, barium and silver were detected in groundwater samples collected from wells in the vicinity of the Mud Holes and Mud Pond (G&M, 1988). Additional sampling and chemical analyses of groundwater detected elevated concentrations of antimony, arsenic, barium, beryllium, copper, cobalt, chromium, lead, manganese, mercury, nickel, vanadium, cadmium, uranium, thorium, molybdenum, bismuth and zinc in the groundwater and/or soils, particularly in the area of the Mud Holes and Mud Pond (NUS, 1990). The results of metal analyses on groundwater

samples from the two investigations are summarized in Table 3-7. Note that Geraghty and Miller filtered their metal samples; a review of the NUS field notes did not indicate that groundwater samples collected by NUS were filtered. This is probably the reason the NUS samples were reported to contain higher concentrations of metals than the Geraghty and Miller samples.

Inorganics: Non-Metals

Groundwater samples were collected and analyzed for chloride, sulfate and nitrate in the spring of 1988 (Table 3-7). Chloride was detected at concentrations exceeding the New York State groundwater standard (250,000 $\mu\text{g/L}$) in five wells located in the southwestern part of the site. Chloride concentrations ranged from 260,000 $\mu\text{g/L}$ in GM-6 to 2,700,000 $\mu\text{g/L}$ in EMW-4. Sulfate was detected at concentrations exceeding the New York State groundwater standard (250,000 $\mu\text{g/L}$) in eight wells. Sulfate concentrations ranged from Table 3-7, 350,000 $\mu\text{g/L}$ in well GM-3D to 11,000,000 $\mu\text{g/L}$ in well GM-14A. The source of the chloride and sulfate is believed to be the on-site wastewater treatment facility. Nitrate was not detected in concentrations exceeding the New York State groundwater standard (10,000 $\mu\text{g/L}$) in any of the wells sampled.

Pesticides were not detected in any groundwater samples collected (NUS, 1990). The data for pesticides in monitoring well GM-14A indicated that the analysis did not pass USEPA QA/QC criteria.

3.1.8.3 Chemical Characteristics of Off-Site Groundwater

Off-site groundwater investigations in the vicinity of the Li Tungsten site have been conducted at two adjacent sites, the Mattiace Petrochemical site (EBASCO, 1991) and the former Powers- Chemco site. The Mattiace site is a former organic solvent bulking, blending and packaging facility that operated from the mid 1960's through 1987 when the facility was abandoned. The RI has documented volatile organic contamination of the on-site groundwater. The contaminants found on the Mattiace site include methylene chloride, trichloroethylene, 1,1,1-trichloroethane, and tetrachloroethene (EBASCO, 1991).

TABLE 3-7
INORGANIC ANALYSIS DATA, GROUND WATER
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Well Number	GM-3D	GM-4	GM-5	GM-10	GM-14	GM-17	EMW-3	EMW-4	EMW-4#
Date	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90
Inorganic Compound									
Aluminum	115000	32600	152000	171000		3970	3910	122000	120000
Antimony		68.8	J		3390	276	J	184	212
Arsenic	J		J	J	R	81.7	31.8	2690	2800
Barium	894	525	963	707	J	J	J	J	J
Beryllium	9.4	J	11	11.1				11.2	12.3
Cadmium	14E		53.6			29.1			
Calcium	88100	26100	39900	28000	214000	90600	130000	541000	572000
Chromium	271	97.9	369	344	J	23.7	20.9	137	132
Cobalt	109	128	115	221		703	58.9	353	358
Copper	2080E	171E	231E	276E	J	391E	60.8E	231E	212E
Iron	231000	228000	246000	257000	6390	9450	34200	370000	384000
Lead	121	31.1	146	209	R	198	7.3	144E	88.6E
Magnesium	42500	17900	57200	46300	J	13000	19300	179000	187000
Manganese	8190	3990	3900	7620	1730	1480	829	35300	37300
Mercury		0.42	0.25	13	0.48	0.87	0.29	0.28	0.25
Nickel	225	135	243	213		525	50	339	336
Potassium	11400E	10100E	34100E	14100E	J	8720E	9380E	25400E	25600E
Selenium						J			
Silver						J			
Sodium	45500	10600	23300	9940	13100000	117000	35900	1390000	1460000
Thallium									
Vanadium	320	125	421	512	198	J	J	198	181
Zinc	1820E	508E	632E	825E	5940E	3840E	160E	5940E	6200E
Cyanide	11.4			13.6					

NOTES: All results are from the NUS Corporation report, 1990.

NA= Not analyzed

Blank space= Compound analyzed for but not detected

All concentrations are in micrograms per liter (µg/L)

#= Duplicate sample

Samples collected for metals analysis were not filtered

TABLE 3-7 (CONTINUED)
INORGANIC ANALYSIS DATA, GROUND WATER
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Well Number	GM-1	GM-2	GM-3D	GM-4	GM-5	GM-6	GM-6#	GM-7	GM-8	GM-9	GM-10	GM-11
Date	04/07/88	04/07/88	04/08/88	04/07/88	04/07/88	04/07/88	04/07/88	04/08/88	04/08/88	04/08/88	04/15/88	04/15/88
Inorganic Compound												
Calcium as Ca	85000	65000	90000	19000	26000	150000	150000	26000	36000	55000	21000	25000
Cobalt as Co		8	100						5		24	
Nickel as Ni			150									
Sodium as Na	30000	100000	44000	14000	26000	120000	130000	28000	18000	34000	12000	14000
Lead as Pb						8	5					
Chromium as Cr												
Cadmium as Cd			20	1.4					13			
Arsenic as As		11				3	2					
Tantalum	75	280	330	53	51	140	140	70	270	110		
Tungsten	380			510	200		290				400	110
Copper as Cu	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum as Mo	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride as Cl	50000	110000	65000	7000	59000	260000	260000	14000	26000	43000	14000	22000
Nitrate as N					3800				600	1000	26000	3500
Sulfate as SO4	130000	32000	350000	16000	40000	450000	450000	68000	230000	150000	48000	50000

NOTES: All results are from the Geraghty & Miller report, 1988

NA= Not analyzed

Blank space= Compound analyzed for but not detected

All concentrations are in micrograms per liter ($\mu\text{g/L}$)

= Duplicate sample

Samples collected for metals analysis were not filtered

TABLE 3-7 (CONTINUED)
INORGANIC ANALYSIS DATA, GROUND WATER
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Well Number	GM-12	GM-13	GM-14A	GM-15	GM-16	EMW-1	EMW-1	EMW-2	EMW-3	EMW-4	EMW-5
Date	04/15/88	04/15/88	04/15/88	04/15/88	04/15/88	04/08/88	04/08/88	04/07/88	04/07/90	04/07/90	04/08/88
Inorganic Compound											
Calcium as Ca	110000	120000	370000	48000	14000	90000	90000	70000	340000	620000	190000
Cobalt as Co		400	400	30	10	270	320		3500	400	720
Nickel as Ni			200			450	400		450	350	250
Sodium as Na	29000	96000	6600000	48000	7900	34000	34000	100000	1000000	2000000	320000
Mercury as Hg						5	5				
Lead as Pb			70			5	5		60	75	
Chromium as Cr			50			5	5		6		
Cadmium as Cd					7	34			29		17
Arsenic as As		2	780	2		2	2	4	140	390	69
Tantalum			2260			90	340	270	1760	3910	520
Tungsten			39400	160				4690	154000	1630	42800
Copper as Cu	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum as Mo	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride as Cl	65000	25000	700000	120000	8000	65000	65000	91000	1900000	2700000	740000
Nitrate as N			1000								
Sulfate as SO4	150000	430000	1E+07	48000	200000	400000	350000	8000	1100000	3300000	450000

NOTES: All results are from the Geraghty & Miller report, 1988.

NA= Not analyzed

Blank space= Compound analyzed for but not detected

All concentrations are in micrograms per liter (µg/L)

= Duplicate sample

Samples collected for metals analysis were not filtered

It is believed that the Mattiace site may have impacted groundwater quality on the Li Tungsten site. The same volatile organic contaminants found in groundwater on the Mattiace site have also been detected in groundwater on the Li Tungsten site, particularly 1,1,1-trichloroethane, trichloroethylene and tetrachloroethene in GM-10.

Monitoring well MW-6S located on the Mattiace site is located approximately 150 feet southwest of monitoring well GM-10 located on Parcel C'. Analysis of a floating non-aqueous phase liquid (NAPL) in well MW-6S detected the presence of six volatile organic compounds at very high concentrations. The highest concentrations detected were trichloroethene and toluene, both at 120,000 $\mu\text{g/L}$. Tetrachloroethene was detected at 98,000 $\mu\text{g/L}$ and xylene was detected at 61,000 $\mu\text{g/L}$. Two 20,000 gallon underground storage tanks, located near MW-6S, were previously used to store toluene and xylene. Other solvents were also stored in nearby underground and aboveground tanks.

The groundwater flow direction in the vicinity of well MW-6S is toward the northwest as a local groundwater divide occurs on the Mattiace site (EBASCO, 1991). From this information, it appears that the source of the VOCs in well GM-10 could be from the Mattiace site.

The former Powers-Chemco site, located approximately 800 feet northeast of Li Tungsten is currently undergoing an RI/FS investigation by the NYSDEC. Although there is no available published reports on the Powers-Chemco site, the Mattiace RI Report does contain some site-specific information (EBASCO, 1991). Drums of waste were buried on the Mattiace site during past operations. The drums were removed in the early 1980's, but the "contaminated" adjacent soils were placed back into the excavation. To date, 11 monitoring wells have been installed. The analyses of water samples collected in 1986 from these wells have detected VOCs (EBASCO, 1991). Toluene was detected in 6 of the 11 wells of concentrations ranging from 20 to 23,000 $\mu\text{g/L}$. Xylene was detected in wells MW-9 (30 $\mu\text{g/L}$) and MW-11 (40 $\mu\text{g/L}$). Tetrachloroethene, trichloroethylene, cis/trans-1,2-dichloroethene were detected only in well MW-9A at low concentrations. Groundwater flow across the site is to the south; the same general flow direction identified on the Li Tungsten site. The nearest wells to the former Powers-Chemco site are GM-5 and GM-13. Volatile organics have not been detected in well GM-5. Low concentrations of 1,2 dichloroethene

and trichloroethylene were detected in GM-13. The former Powers- Chemco site does not appear to represent an off-site source because of the low concentrations detected in nearby monitoring wells.

Downgradient of the former Powers-Chemco site is a former dry cleaning establishment. Immediately downgradient of the dry cleaner is Parcel A on the Li Tungsten site. The former dry cleaning site has not undergone a groundwater investigation. Contaminants found in some monitoring wells on the Li Tungsten site are known to be used in dry cleaning operations (e.g., trichloroethene, tetrachloroethene, trans-1,2-dichloroethene); These contaminants are also detected in the groundwater upgradient of the former dry cleaning facility at concentrations ranging from 30 to 120 $\mu\text{g/L}$ in two wells; MW-9A and MW-1. The former dry cleaners site may represent a potential source of the VOCs detected on Parcel A.

3.1.8.4 Chemical Characteristics of Surface Water

Surface water samples were collected at 11 locations (SW-1 through SW-4, SW-6 through SW-10, SW-1* and SW-2*) as shown on Figure 3-1 (NUS, 1990). Samples were analyzed for volatile and semi-volatile organic compounds, pesticides/PCBs, and inorganic compounds (metals and non-metals). The following is a summary of where the surface water samples were collected:

- SW-1 was collected from an open tank on Parcel A.
- SW-2, SW-3 and SW-4 were collected from the northern mud hole, the southern mud hole and Mud Pond, respectively, located on Parcel C.
- SW-2* was collected from standing water in the East Dice building on Parcel A.
- SW-3* was collected from the oil recovery sumps on Parcel A.
- SW-6 and SW-7 were collected from outfalls on Parcel A.
- SW-8 was collected from a pond on Parcel B.
- SW-9 was collected from an intermittent stream located upgradient of the pond outlet on Parcel B.

- SW-10 was collected from standing water in the warehouse building.

VOCs were detected at three surface water sampling locations; SW-2, SW-6, and SW-8. Trichloroethylene and 1,1,2-Trichloroethane, at concentrations of 7 and 36 $\mu\text{g/L}$, respectively, were found in sample SW-2*. Tetrachloroethene was detected at SW-6 and SW-7, in concentrations of 14 and 19 $\mu\text{g/L}$, respectively. Acetone was detected in sample SW-8 at a concentration of 15 $\mu\text{g/L}$. VOC analytical results are summarized in Table 3-8.

PCBs were detected in two of the samples; SW-1 and SW-3. Sample SW-1 had a PCB concentration of 2 $\mu\text{g/L}$ and sample SW-3 had a total PCB concentration of 5 $\mu\text{g/L}$. PCBs were also detected in the sediment of the southernmost Mud Hole. Pesticide/PCB sample analytical results are summarized in Table 3-9.

Inorganic compounds (both metal and non-metal) were detected in all 11 of the surface water sampling locations. The parameters with the highest concentrations were calcium, magnesium, potassium and sodium. Mercury was detected in two samples collected in each Mud Hole at concentrations of 0.21 $\mu\text{g/L}$ for sample SW-2 and 0.66 $\mu\text{g/L}$ for sample SW-3.

Sample SW-6 contained iron (871 $\mu\text{g/L}$) and tetrachloroethene (14 $\mu\text{g/L}$). Inorganic surface water analytical results are summarized in Table 3-10.

3.1.8.5 Chemical Characteristics of Sediments

Sediment samples were collected at eight locations (SED-1*, SED-2 through SED-4 and SED-6 through SED-9) as shown on Figure 3-1 (NUS, 1990). These samples were analyzed for VOCs, semi-volatiles, pesticides/PCBs and inorganics (metals and non-metals).

VOCs were identified in samples, SED-6 (44 $\mu\text{g/Kg}$ of 2-butanone). Sample SED-6 was collected in the vicinity of the southernmost outfall from the Li Tungsten site to Glen Cove Creek. A summary of the VOC sample results is presented on Table 3-11.

Laboratory analyses identified semi-volatile organic compounds at three sediment sampling locations; SED-4, SED-6, and SED-7. Sample SED-4 was collected in Mud Pond and a

TABLE 3-8
VOLATILE ORGANIC ANALYSIS DATA, SURFACE WATER
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Sample Number	SW-6	SW-7	SW-8	SW-2*
Date	04/18/90	04/18/90	04/18/90	05/15/90
Compound				
Acetone			15	
trans-1,2 Dichloroethene (total)	J	J	J	
Trichloroethene	J	J	J	7
1,1,2-Trichloroethane				36
Tetrachloroethene	14	19	J	

NOTE: J = Compound present below CRQL but above IDL.
 All concentrations are in micrograms per liter ($\mu\text{g/L}$)

TABLE 3-9
PESTICIDES ANALYSIS DATA, SURFACE WATER
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Sample Number	SW-1	SW-3	SW-8	SW-13#
Date	04/18/90	04/18/90	04/18/90	04/18/90
Compound				
4,4-DDD			0.17	
Aroclor 1248		2.6		
Aroclor 1254	2	1.4		2.2

NOTES: All concentrations are in micrograms per liter ($\mu\text{g/L}$)

#= SW-13 is a duplicate of SW-1

R=Analysis did not pass EPA QA/QC.

TABLE 3-10
INORGANIC ANALYSIS DATA, SURFACE WATER
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Sample Number	SW-1	SW-2	SW-3	SW-4	SW-6	SW-7	SW-8	SW-9	SW-10	SW-1*	SW-2*	SW-3*#
Date	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	05/15/90	05/15/90	05/15/90
Inorganic Compound												
Aluminum	J	409	931	204	J	J	581	338	J	J	J	J
Antimony		73.1	212				86.2		877			
Arsenic	J	50.2	145E	15.2			43.8	17.2	J	J	J	J
Barium	J	J	J	J	J	J	J	J	J	J	J	J
Cadmium							7.5E		15.2			
Calcium	6560	6670	40600	449000	71200	32400	53500	37700	37500	90700	53100	94100
Chromium		J	J						66.2			
Cobalt		61.2	475	85.8	J		3020	805	17500	51	366	53
Copper	J	103E	640E	48.2E	J	J	169E	55.9E	1570	25	504	25
Iron	174	2150	4530	547	871	663	17300	24200	6580	J	1760	J
Lead	J	141	195	102E	J		30.8	13.2E	153	4.2E	15.8E	3.9E
Magnesium	J	J	J	15900	175000	29000	14700	12700	18600E	J	12500	J
Manganese	J	108	535	138	173	93.5	2280	7200	29500	J	1640	J
Mercury		0.21	0.66						0.84			
Nickel	J	50	140	J	J		1700	369	76000	J	544	J
Potassium	J	J	J	5920E	49000E	9290E	8870E	J	7630	24900E	22200	24700E
Selenium				J							J	
Silver	J	15	23.6	J					34.6			
Sodium	36100	14100	56300	21700	1360000	202000	69800	21300	464000	919000	53100	867000
Vanadium							J			J		J
Zinc	20.7E	93.3E	229E	31.4E	J	J	1530E	81.4E	R	30.7	265E	35.8
Cyanide										J	11.7	11.4

NOTES: All results are from the NUS Corporation report, 1990.
 All results are in micrograms per milliliter (µg/L)
 E = Estimated value
 J = Compound present below CRQL but above detection limit
 R = Analysis did not pass EPA QA/QC
 Blank space = Compound analyzed for but not detected
 * = Sample taken May, 1990.
 # - Sample SW-3* was duplicate of SW-1*

TABLE 3-11
VOLATILE ORGANIC ANALYSIS, SEDIMENT SAMPLES
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Sample Number	SED-6	SED-7	SED-1*	SED-2*
Date	04/18/90	04/18/90	05/15/90	05/15/90
Compound				
Methylene Chloride			J	
2-Butanone	44E	J	R	R
Trichloroethene	J			

NOTES: E = Estimated value.

J = Compound present below CRQL but above IDL.

R = Analysis did not pass EPA QA/QC.

All concentrations are in micrograms per kilogram ($\mu\text{g/Kg}$)

concentration of 580 $\mu\text{g/Kg}$ of bis (2-Ethylhexyl) phthalate was detected. Samples SED-6 and SED-7 contained total semi-volatile concentrations of 12,240 $\mu\text{g/Kg}$ and 34,500 $\mu\text{g/Kg}$, respectively. Both samples, SED-6 and SED-7, were collected in the vicinity of outfalls from the Li Tungsten site to Glen Cove Creek. Semi-volatile analytical results are summarized on Table 3-12.

Pesticide/PCB contamination was detected at 6 of the 9 sediment sampling locations. Sample SED-7, SED-8 and SED-9 contained total pesticide concentrations of 70 $\mu\text{g/L}$, 320 $\mu\text{g/Kg}$, and 67 $\mu\text{g/Kg}$, respectively. Samples SED-2, SED-3 and SED-4, which were collected in the two mud holes and Mud Pond, showed total PCB concentrations of 11,200 $\mu\text{g/Kg}$, 50,000 $\mu\text{g/Kg}$ and 610 $\mu\text{g/Kg}$, respectively. Sample SED-3, collected in the southernmost mud hole on Parcel C, contained a single PCB concentration of 50,000 $\mu\text{g/Kg}$, which exceeds the corrective action limit established by the NYSDEC. The sediment sample results for pesticides and PCBs are summarized in Table 3-13.

Metal and non-metal inorganic compounds were identified in all seven of the sediment sampling locations. Mercury was detected by the laboratory in five of the samples as an estimated quantity. Metals including aluminum, calcium, chromium, iron and lead were detected consistently across the site in the majority of sediment samples. A summary of the inorganic sample results is presented in Table 3-14.

3.1.8.6 Summary of Sources and Chemical Characterization

The contamination at the Li Tungsten site exists in the groundwater, soil, surface water and sediments. The groundwater contains VOCs and inorganic compounds. VOCs are present in two areas and appear to be related to two off-site sources. The inorganic contamination on-site is a result of the past facility operations and disposal practices. Drums, crates and piles of processed ore and slag will continue to act as contaminant source to the groundwater until they are removed. The disposal area on Parcel B, the two Mud Holes, the Mud Pond and the storm drains are also potential contaminant sources.

TABLE 3-12
SEMI-VOLATILE ANALYSIS DATA, SEDIMENT
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Sample Number	SED-1	SED-2	SED-3	SED-4	SED-6	SED-7
Date	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90
Compound						
Phenol						J
Benzoic acid		J	J		J	J
Acenaphthylene					J	
Acenaphthene					J	J
4-Nitrophenol			J			
Dibenzofuran						J
Flourene					J	J
Phenanthrene					J	2700
Anthracene					J	J
Di-n-butylphthalate					J	J
Fluoranthene					1600	6800
Pyrene				J	1200	3800
Butylbenzylphthalate					J	J
Benzo(a)anthracene		JN			810	2400
Chrysene		JN			870	3000
bis(2-Ethylhexyl)phthlate	J			580	3000	7200
Di-n-octylphalate					J	J
Benzo(b)fluoranthene		JN	JN	JN	2000EN	3600
Benzo(k)fluoranthene		JN	JN	JN	2000EN	2500
Benzo(a)pyrene					760	2500
Ideno(1,2,3-cd)pyrene					J	J
Dibenz(a,h)anthracene					J	J
Benzo(g,h,i)perylene					J	J

NOTES: All results are from NUS Corporation r
E = Estimated value.
J = Compound present below CRQL but above IDL.
N = Presumptive evidence of the presence of the material.
All concentrations are in micrograms per kilogram ($\mu\text{g/Kg}$)

TABLE 3-13
PESTICIDES ANALYSIS DATA, SEDIMENTS
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Sample Number	SED-2	SED-3	SED-4	SED-6	SED-7	SED-8	SED-9
Date	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90
Compound							
alpha-BHC				R			
beta-BHC				R			
delta-BHC				R			
gamma-BHC (Lindane)				R			
Heptachlor				R			
Aldrin				R			
Heptachlor epoxide							67E
4,4-DDE						170	
4,4-DDD					70	150	
Aroclor 1248	9600	50000	610				
Aroclor 1254	1600						

NOTES: All results are from the NUS Corporation report, 1990.

R = Analysis did not pass EPA QA/QC

All concentrations are in micrograms per Kilogram ($\mu\text{g/Kg}$)

TABLE 3-14
INORGANIC ANALYSIS DATA, SEDIMENT SAMPLES
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Sample Number	SED-2	SED-3	SED-4	SED-6	SED-7	SED-8	SED-9	SED-1*	SED-2*#
Date	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	04/18/90	05/15/90	05/15/90
Inorganic Compound									
Aluminum	2190	3560	12600	6000E	9200E	7970	5540E	1350	610
Antimony	3320E	3290E	245E				104E		R
Arsenic	1240	1770	228	20.1E	17.1E	45.9	193E	72.1	37
Barium	333	387	131	J	J	106	1340E	J	J
Beryllium			2.8	J	J	J	J	J	J
Cadmium	5.6	10.1	5.9	8.3E	R		J	2.7	
Calcium	2800	24000	149000	6640E	19900E	J	13200E	202000	308000
Chromium	24.5	78.7	62	34.5E	47.4E	20.4	87.6E	35.4	21.5E
Cobalt	18.1	60.8	1390	53.6E	30E	92.1	7910E	3970	1530
Copper	171E	454E	994E	281E	268E	26.1E	571E	610	293
Iron	46400	145000	20900	19200E	21000E	22800	239000E	2780	1980
Lead	2950	5140	937	254E	345E	31.5E	356E	341	243
Magnesium	J	J	24100	4240E	7990E	1990	J	J	J
Manganese	221	260	1110	245E	212E	205	65100E	1090	491
Mercury	4.4E	9E	0.71E	0.45E	0.53E			0.23	0.21
Nickel			291	82.3E	48.3E	44.4	3330E	1110	450
Potassium	J	3430	3510	J	J	J	J	J	
Selenium	J	19E							
Silver	103	136	32.2	33.8E	37.6E			14.3	7.6
Sodium		J		5150E	13500E		23.6E	7720E	12600E
Thallium	R	R	R	R	R	R	R	R	R
Vanadium			56.5E	28.8E	37.7E	32.9E	J	112E	57.2E
Zinc	119E	197E	551E	1720E	390E	96.9E	622E	782E	303E

NOTES: All results are from the NUS Corporation report, 1990.
All concentrations are in micrograms per kilogram ($\mu\text{g/Kg}$)
E = Estimated value
J = Estimated value; compound present below CRQL but above IDL.
R = Analysis did not pass EPA QA/QC
Blank space = Compound analyzed for but not detected
* = Sample taken in May, 1990
= SED-2* is duplicate of SED-1*.

The surface water contamination consists mostly of inorganic compounds and relative low levels of VOCs. Potential contaminant sources affecting surface water contamination consists of runoff from the residual ores, the disposal area in Parcel B, and the storm drains.

3.1.9 Site Safety

During the site visit on September 1, 1992 several safety related observations were made. These observation related to obstructions and site conditions that would affect worker safety in the performance of RI field investigation tasks. The safety related observations consisted of the following:

- **Overstacking of drums.** Drums of various sizes containing various forms of processed tungsten ore have been stacked up to four and five drums high. Many of these drums have corroded and/or tipped over to a point where they have become physically unstable.
- **Physical obstructions.** Many of the drum piles are located in courtyard areas, adjacent to buildings, and along narrow walkways in such a way as to obstruct or present a hazard to pedestrian traffic.
- **Structural integrity of buildings.** The walls and/or roofs of several buildings (e.g., Dice Building/Warehouse and the Reduction Building) have partially collapsed and is unsafe for entry. Based on the results of the structural integrity survey, building demolition may be appropriate.
- **Slip, Trip and Fall Hazards.** In general, numerous conditions were observed that present potential slip, trip and fall hazards. For example, standing water up to several feet deep in the western end of the Dice building conceals a deep pit in the floor.
- **Asbestos Containing Material (ACM).** Deterioration of friable ACM in the form of pipe wrap and tank insulation was observed both in the interior and exterior of buildings.
- **Radiation.** Drums and wooden crates containing various forms of processed and unprocessed tungsten ore containing varying concentrations of radionuclides (Th, Ra and U) are present throughout Parcels A and C.
- **Tanks, Vessels and Pipelines.** The potential for pressurized liquids in tanks and pipelines needs to be evaluated.
- **Miscellaneous.** Includes other safety concerns such as the condition of the Glen Cove Creek bulkhead, electrical and lighting, and HVAC.

To eliminate these safety hazards, we propose that interim remedial measures be implemented at the site to address each of the safety hazards, before RI field investigation tasks are initiated. Additional details on the proposed interim remedial actions are provided in Section 3.7.

3.2 PRELIMINARY IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Section 121(d)(2)(A) of CERCLA incorporates into law the CERCLA Compliance Policy, which specifies that Superfund remedial actions meet any federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). State ARARs must be met if they are more stringent than federal requirements. Furthermore, Section 121 requires the selection of a remedial action that is protective of human health and the environment. Determining protectiveness involves a risk assessment in accordance with CERCLA guidance.

To Be Considered Material (TBCs) are non-promulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs. As described below, TBCs will be considered along with ARARs as part of the site risk assessment and may be used in determining the necessary level of cleanup for protection of health and the environment.

ARARs (and TBCs necessary for protection) must be attained for hazardous substance pollutants, or contaminants remaining on-site at the completion of the remedial action unless waiver of an ARAR is justified. In addition, the USEPA intends that implementation of remedial actions should also comply with ARARs (and TBCs, where appropriate) to protect public health and the environment. ARARs (and TBCs necessary for protection), pertaining both to contaminant levels and to performance or design standards, should generally be attained at all points of potential exposure, or at the point specified by the ARAR itself.

This section of the Work Plan provides a preliminary determination of the federal and environmental and public health requirements that are potential ARARs and TBCs for

site. The information in this section is based upon USEPA guidance documents (USEPA, 1988b; USEPA, 1989e), and USEPA's Generic Work Plan (USEPA, 1989c).

3.2.1 Definition of ARARs

General

A requirement under other environmental laws may be either "applicable" or "relevant and appropriate," but not both. Identification of ARARs must be done on a site-specific basis and involves a two-part analysis: first, a determination whether a given requirement is applicable; then if it is not applicable, a determination whether it is nevertheless both relevant and appropriate.

Applicable Requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

Relevant and Appropriate Requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

Three classifications of ARARs have been established and include:

- Chemical-Specific - Usually health or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment;
- Location-Specific - Restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations; and
- Action-Specific - Usually technology or activity-based requirements or

limitations on actions taken with respect to hazardous wastes.

Radioactivity

Public health standards and guidelines for ionizing radiation are concerned with protecting individuals and future generations from unnecessary exposures. Standards addressing occupational exposure limits mandate the reduction of all exposures to levels that are as low as reasonably achievable (ALARA), in consideration of technical, economic, and social factors.

Regulatory responsibilities for radiation protection are shared by the USEPA, the Nuclear Regulatory Commission (NRC), the Occupational Safety and Health Administration (OSHA), the Department of Energy (DOE), the Department of Transportation (DOT), and agencies within the 50 state governments. In some cases, regulations incorporate the recommendations of organizations such as the International Commission on Radiological Protection (ICRP), the National Council on Radiation Protection and Measurements (NCRP), and the Committee on the Biological Effects of Ionizing Radiation (BEIR) of the National Academy of Sciences (NAS).

The radioactive wastes at the Li Tungsten Site can be regulated under CERCLA due to two federal laws, the Clean Air Act (CAA) and the Safe Water Drinking Act (SWDA). Radon is classified as a hazardous substance under Section 112 of the CAA and Thorium is regulated under the primary safe drinking water standards and can therefore be considered a hazardous substance under CERCLA.

3.2.2 Consideration of ARARs During the RI/FS

ARARs will be considered at the following intervals during the RI/FS process:

- Scoping of the RI/FS. Identify chemical-specific and location-specific ARARs on a preliminary basis, in order to plan the site characterization sampling locations, and analytical Data Quality Objectives (DQOs) (including any required Special Analytical Services (SAS)).
- Site characterization and risk assessment phases of the RI. Identify the

chemical-specific ARARs and TBCs and location-specific ARARs more comprehensively and use them to help determine the cleanup goals.

- Development of remedial alternatives in the FS Report. Identify action-specific ARARs for each of the proposed alternatives and consider them along with other ARARs and TBCs.
- Detailed evaluation of alternatives. Examine all the ARARs and TBCs for each alternative as a package to determine what is needed to comply with laws and regulations and whether or not compliance is expected.
- Selection of remedy. Select an alternative able to attain all ARARs, unless one of the six statutory waivers is invoked.
- Remedial design. Ensure that the technical specifications of remedy construction attain ARARs.

As the RI/FS progresses, the list of ARARs will be continually updated. ARARs will be used as a guide to establish the sampling strategy and the appropriate extent of site cleanup; to aid in scoping, formulating and selecting proposed treatment technologies; and to govern the implementation/operation of the selected action. Primary consideration will be given to remedial alternatives that attain or exceed the requirements found in the ARARs. At each interval, ARARs are identified and utilized by taking into account the following:

- Contaminants suspected to be at the site
- Chemical analyses to be performed
- Types of media to be sampled
- Geology and other site characteristics
- Use of the resource/medium
- Level of exposure and risk
- Potential transport mechanism
- Purpose and application of the potential ARARs
- Remedial alternatives that will be considered for the site

3.2.3 Preliminary Identification of Potential ARARs and TBCs

The following lists identify potential ARARs and TBCs for the site. Requirements for selected, significant, chemical, location and action-specific federal ARARs and TBCs are presented in Appendix A.

3.2.3.1 Potential ARARs

Chemical-Specific Federal ARARs

- Safe Drinking Water Act, Maximum Contaminant Levels (MCLs) (40 CFR Parts 141.11-16).
- Resource Conservation and Recovery Act (RCRA) Groundwater Protection Standards and Maximum Concentration Limits (40 CFR Part 264, Subpart F).
- Resource Conservation and Recovery Act (RCRA) TCLP requirements for waste disposal.
- Clean Water Act, Water Quality Criteria (Section 364).
- National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50).
- National Emission Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR Part 61).
- Atomic Energy Act of 1954, as amended in 1977.
- Standards for Protection Against Radiation: Final Rule (10 CFR Part 20).
- Environmental Radiation Protection Standards for Nuclear Power Operations (40 CFR Part 190).
- Health and Environmental Protection Standards For Uranium and Thorium Mill Tailings (40 CFR Part 192).
- Environmental Radiation Protection Standards for Low-Level Radioactive Waste Disposal (40 CFR Part 193).

Chemical-Specific State ARARs

- New York State Groundwater Quality Standards (6 NYCRR Part 703).
- New York State Safe Drinking Water Act Maximum Contaminant Levels

- (MCLs) (10 NYCRR Part 5).
- New York State Surface Water Quality Standards (6 NYCRR Part 702).
- New York Raw Water Quality Standards (10 NYCRR Part 170.4).
- New York RCRA Groundwater Protection Standards (6 NYCRR Part 373-2.6[e]).
- New York Ambient Air Quality Standards (5 NYCRR Parts 256 and 257).
- Rules and Regulations for Prevention and Control of Environmental Pollution by Radioactive Materials (6 NYCRR Parts 380.9-10).

Location-Specific Federal ARARs

- Protection of Wetlands (Executive Order 11990).
- USEPA's 1985 Statement on Floodplains and Wetlands Assessments for CERCLA actions.
- National Historic Preservation Act (16 CFR Part 470) Section 106 et seq.
- RCRA Location Requirements for 100-year Floodplains (40 CFR Part 264.18(b)).
- Fish and Wildlife Coordination Act (16 USC 661 et seq.).

Location-Specific State ARARs

- New York State Freshwater Wetlands Law (Environmental Conservation Law (ECL) Article 24, 71 in Title 23).
- New York State Freshwater Wetlands Permit Requirements and Classification (6 NYCRR Parts 663 and 664).
- New York State Floodplain Management Act and Regulations (ECL Article 36 and 6 NYCRR Part 500).
- Endangered and Threatened Species of Fish and Wildlife Requirements (6 NYCRR Part 182).
- New York State Flood Hazard Area Construction Standards.

Action-Specific Federal ARARs

- **Underground Injection of Treated Groundwater (UIC) (40 CFR Parts 144, 146, 147).**
- **RCRA Subtitle C Closure and Post-Closure Standards (40 CFR Part 264, Subpart G).**
- **RCRA Groundwater Monitoring and Protection Standards (40 CFR Part 264, Subpart F).**
- **RCRA Generator Requirements for Manifesting Waste for Off-site Disposal (40 CFR Part 263).**
- **RCRA Transporter Requirements for Off-Site Disposal (40 CFR Part 270).**
- **RCRA Subtitle D Nonhazardous Waste Management Standards (40 CFR Part 257).**
- **RCRA Land Disposal Restrictions (40 CFR Part 268) (On- and off-site disposal of excavated soil).**
- **Clean Water Act - NPDES Permitting Requirements (40 CFR Parts 122-125).**
- **Clean Water Act Discharge to Publicly - Owned Treatment Works (POTW) (40 CFR Part 403).**
- **National Emission Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR Part 61).**
- **DOT Rules for Hazardous Materials Transport (49 CFR Parts 107, 171.1-171.500, 173.4).**
- **Occupational Safety and Health Standards for Hazardous Responses and General Construction Activities (29 CFR Parts 1904, 1910, 1926).**
- **Toxic Substances Control Act (For PCB Storage Prior to Disposal, Landfilling) (40 CFR Part 761).**
- **Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes (40 CFR Part 191).**
- **Uranium Mill Tailings Radiation Control Act (UMTRCA).**

Action-Specific State ARARs

- New York State Pollution Discharge Elimination System (SPDES) Requirements (Standards for Storm Water Runoff, Surface Water, and Groundwater Discharges) (6 NYCRR Parts 750-757).
- New York State RCRA Standards for the Design and Operation of Hazardous Waste Treatment Facilities (e.g., landfills, incinerators, tanks, containers, etc.). Minimum Technology Requirements (6 NYCRR Parts 370-372).
- New York State RCRA Closure and Post-Closure Standards (Clean Closure and Waste-in-Place Closures) (6 NYCRR Part 372).
- New York State Solid Waste Management Requirements and Siting Restrictions (6 NYCRR Parts 360-361).
- New York State RCRA Generator and Transporter Requirements for Manifesting Waste for Off-Site Disposal (6 NYCRR Parts 364 and 372).
- New York State Air Emissions Requirements (VOC Emission from Air Strippers and Process Vents, General Air Quality) (6 NYCRR Parts 200-212).
- Rules and Regulations for Prevention and Control of Environmental Pollution by Radioactive Materials (6 NYCRR Parts 380.9-10).

3.2.3.2 Potential Radioactivity ARARs and TBCs

Public health standards and guidelines for ionizing radiation are concerned with protecting individuals and future generations from unnecessary exposures. Standards addressing occupational exposure limits (such as those promulgated by the USEPA and the NRC discussed below) mandate the reduction of all exposures to levels that are as low as reasonably achievable (ALARA), in consideration of technical, economic, and social factors. These occupational standards are not ARARs but will be adhered to during any future remedial activities.

The radionuclides uranium and thorium and their decay products (which include radium) are listed as hazardous substances under CERCLA in 40 CFR 302.4 because they are classified as hazardous substances under Section 112 of the Clean Air Act.

Regulatory responsibilities for radiation protection are shared by the USEPA, NRC, OSHA, DOE, DOT, and agencies within the 50 State governments. In some cases, regulations incorporate the recommendations of organizations such as the International Commission on Radiological Protection (ICRP), the National Council on Radiation Protection and Measurements (NCRP), and the Committee on the Biological Effects of Ionizing Radiation (BEIR) of the National Academy of Sciences (NAS).

Three distinct contaminant-specific ARARs and TBCs are described below. Exposure limits regulate the acceptable amounts of whole body dose equivalent to members of the general public and to workers at commercial facilities which utilize radioactive materials. Radon and radon decay product ARARs limit the concentration of radon gas and radon decay products inside homes and buildings. ARARs addressing specific radionuclides, such as thorium, have been promulgated to limit the concentration of radionuclides in soil.

The U.S. Atomic Energy Act (AEA) of 1954 granted the Federal Radiation Council (FRC) the authority to establish generally applicable environmental standards for exposure to radiation and radioactive materials. In 1970, the functions of the FRC were transferred to the USEPA. Since that time, the USEPA has revised the existing federal guidance for the control of occupational radiation hazards several times. The most recent revision, Federal Guidance Report No. 11 (USEPA, 1988c), contains an occupational dose equivalent limit of 5 rem per year for public sector workers.

In 40 CFR 192, Health and Environmental Protection Standards For Uranium And Thorium Mill Tailings, the USEPA promulgated regulations which are relevant and appropriate to the U.S. Radium site remedial action. The dose equivalent to the general public inside residences is limited to 20 μ R/h above background. A November 19, 1986 memo from the USEPA's Office of Radiation Programs to the USEPA Region II Radiation Program Branch Manager recommended a 170 mrem/year above background whole body dose equivalent limit at residences to members of the public (Meyers, 1986). This guidance, applied to gamma radiation exposure in residences, is by definition a TBC, since it has not been promulgated into any radiation control standard. This limit corresponds to a continuous whole body exposure rate of approximately 20 μ R/h for an entire year. Therefore, it may be assumed that this limit would pertain to both indoor and outdoor exposures.

Occupational control of radiation exposures is addressed by OSHA in 29 CFR 1910.120, Hazardous Waste Operations And Emergency Response. Radiation monitoring is required during initial investigations of hazardous waste facilities. Radioactive wastes must not be handled until the hazard to workers is assessed. OSHA regulations are not ARARs, but compliance with OSHA regulations is required for workers at the site.

NRC has the authority to set regulations governing occupational radiation exposure in the private sector. In NRC's recently revised regulations, 10 CFR 20, Standards for Protection Against Radiation; Final Rule, the 5 rem per year occupational dose equivalent limit was unchanged. However, the dose equivalent limit for the general public was reduced to 100 mrem per year from the previous limit of 500 mrem per year, resulting in a limit compatible with that recommended by the ICRP (ICRP, 1990).

The DOE is responsible for setting standards to protect DOE employees and contractors and the general public from radiation exposures resulting from the use of radioactive materials at DOE facilities. In DOE 5480.11, Radiation Protection For Occupational Workers, the occupational limit is set at 5 rem per year. In DOE 5400.5, Radiation Protection Of The Public And The Environment (published in 1990), DOE lowered the acceptable dose equivalent to a member of the public from 500 mrem per year to 100 mrem per year, resulting in a limit compatible with that recommended by the (ICRP).

Risks due to exposure to radon and radon decay products have been evaluated by the USEPA as well as many other scientific bodies. The USEPA has established indoor exposure guidelines in the 1992 Citizen's Guide to Radon (USEPA, 1992a). In addition, 40 CFR 192 provides standards for the control of residual radioactive materials from inactive uranium processing or depository sites which include indoor concentrations of radon and the release of radon to the atmosphere. These guidelines and standards are relevant and appropriate to future use of buildings on the Li Tungsten Site.

The USEPA recommends that indoor radon concentrations should not exceed 4 pCi/L. This is a voluntary guideline and, as such, is a TBC. Radon decay products are limited to an average of 0.02 WL (including background) and a maximum of 0.03 WL (including background) in 40 CFR 192. At 50 percent equilibrium between radon and its decay

products, a 4 pCi/L radon concentration would result in 0.02 WL of radon decay products. The mill tailings standard also limits the release of radon gas to the atmosphere to a rate of 20 pCi per square meter per second and limits the increase in annual average concentration of radon-222 in air at or above any location outside the disposal site to no more than 0.5 pCi/L.

There are no directly applicable standards addressing the concentration limits of materials contaminated with naturally occurring radioactive material (NORM) wastes. In 40 CFR 192, however, USEPA promulgated standards for the stabilization, disposal, and control of uranium and thorium mill tailings from both inactive and active designated uranium mill sites. These standards provide a guideline for remediation/excavation of materials contaminated with ^{232}Th and other naturally occurring radionuclides and many of the standards are relevant and appropriate for the Li Tungsten site because the waste streams, exposure pathways, and subsequent risks at the Li Tungsten site are similar to those at the mill tailings sites.

The risk associated with the dispersal of tailings results from several pathways. In decreasing order of importance, exposure to radon decay products inside of buildings, exposure to gamma radiation both indoors and outdoors, and ingestion of radionuclides in dirt and vegetation contribute to an individual's radiation dose. A primary objective for the remediation of properties contaminated with mill tailings adjacent to and beneath existing structures is to achieve an indoor radon decay product concentration which is less than 0.02 WL. For open land, removal of the contamination must prevent radon decay products in excess of the standard following future construction on the property. To accomplish this objective, 40 CFR 192 requires excavation of soil with average ^{226}Ra (or ^{232}Th) as well as ^{232}Th concentrations greater than 5 pCi/g (over background) over the first 15 cm below the surface and 15 pCi/g in subsequent subsurface soils. These criteria are averaged over areas greater than 100 square meters. In most cases, attaining this degree of cleanup would also meet the indoor gamma radiation standard of reducing the exposure rate to no more than 20 $\mu\text{R}/\text{h}$ over background. Success in bringing radon decay product concentration and exposure rate in compliance with the standards needs to be confirmed by actual measurements.

The soil standard limits of 5 pCi/g at the surface and 15 pCi/g subsurface are relevant and appropriate for remedial actions at the Li Tungsten site. There are no standards regulating the concentration of NORM in building structural materials. A 5 pCi/g limit has been utilized at other CERCLA sites for NORM and would be a TBC for thorium at the Li Tungsten site.

Remediation of radionuclides in soil will also reduce the risk from ingestion of soil to acceptable levels. There currently are no USEPA guidelines specifying acceptable radionuclide concentrations in agricultural soils.

DOE has established soil cleanup guidelines at Formerly Utilized Sites Remedial Action Program (FUSRAP) and Remote Surplus Facilities Management Program (SFMP) Sites for uranium and thorium series radionuclides. These are consistent with 40 CFR 192.

ARARs and TBCs for the site addressing gamma radiation exposure, exposure to radon and radon decay products, and thorium and radium concentration of soils and building materials are summarized in Table 3-15.

NRC has set guidelines for decontamination of building surfaces and equipment prior to their release for unrestricted use from facilities licensed to possess radioactive materials. Items with surface radioactivity levels which do not exceed these levels do not pose an unacceptable risk of radiation exposure to members of the public. The limits for NORM are a TBC; they provide a set of criteria to determine which materials (i.e., structural building components, equipment, furniture, floor tiles, etc.) found on the Li Tungsten site require disposal in a low level radioactive waste disposal facility. They are shown in Table 3-16.

The ingestion of radionuclides in drinking water has been regulated at both the state and federal level. A set of identical maximum contaminant levels (MCLs) have been promulgated by the State of New York in 10 NYCRR Part 5-1.52 and by the USEPA in 40 CFR 141.15-16. These limit the sum of ^{226}Ra and ^{228}Ra to 5 pCi/L, gross alpha activity (excluding radon and uranium isotopes) to 15 pCi/L, and beta/gamma emitters to concentrations resulting in a 4 mrem annual dose equivalent in community water systems.

TABLE 3-15			
IONIZING RADIATION CONTAMINANT-SPECIFIC ARARs AND TBCs			
TYPE	ARAR OR TBC	PERTINENT STANDARD OR GUIDELINE	SOURCES
Gamma Radiation: • Indoor • Outdoor	ARAR TBC TBC	20 μ R/hr above bkg. 170 mrem/yr 100 mrem/yr	40 CFR 192 Meyers, 1986 10 CFR 20
Radon: • Indoor Concentration • Release to atmosphere	TBC ARAR	4 pCi/L 20 pCi/sq.m -s	EPA 1992 40 CFR 192
Radon Decay Products: Average Maximum	ARAR ARAR	0.02 WL 0.03 WL	40 CFR 192 40 CFR 192
Radium and Thorium Soil: • Surface • Subsurface	ARAR ARAR	5 pCi/g 15 pCi/g	40 CFR 192 40 CFR 192
Radium and Thorium Bldg. Materials:	TBC	5 pCi/g	40 CFR 192

TABLE 3-16

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES ^a	AVERAGE ^{b,c,d}	MAXIMUM ^{b,d,f}	REMOVABLE ^{b,e,f}
U-nat, U-235, U-238, and associated decay products	5,000 dpm α /100 cm ²	15,000 dpm α /100 cm ²	1,000 dpm α /100 cm ²
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm ²	300 dpm/100 cm ²	20 dpm/100 cm ²
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm ²	3000 dpm/100 cm ²	200 dpm/100 cm ²
Beta-gamma ($\beta\gamma$) emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5000 dpm $\beta\gamma$ /100 cm ²	15000 dpm $\beta\gamma$ /100 cm ²	1000 dpm $\beta\gamma$ /100 cm ²

NOTES:

- Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma emitting nuclides should apply independently.
- As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
- Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.
- The maximum contamination level applies to an area of not more than 100 cm².
- The amount or removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.
- The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h at 1 cm and 1.0 mrad/h at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

Source: Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material (NRC, 1982).

The MCLs are summarized in Table 3-17.

The discharge of radionuclides to air and water is regulated by the State of New York Department of Environmental Conservation (6 NYCRR Part 380). Release limits for isotopes of radium, thorium, and uranium are shown in Table 3-18. Limits for the release into the sanitary sewer system are shown in Table 3-19.

NORM contaminated material is not considered a hazardous waste under the Resource Conservation and Recovery Act (RCRA), nor does it fall into any classification categories under the AEA or the Low Level Radioactive Waste Policy Act (LLRWPA). There are no provisions under 40 CFR 192 which pertain to the disposal of mill tailings from inactive uranium processing sites at locations other than where the mill tailing piles already exist.

Although there are no applicable or relevant and appropriate federal requirements, disposal of the thorium-contaminated soil and other miscellaneous materials at the Li Tungsten site is regulated by states hosting disposal facilities. It is possible that over the next several years, as more states develop additional disposal facilities as required by the LLRWPA, additional facilities will be available to accept diffuse NORM waste.

Prior to disposal, waste material will be analyzed for chemically hazardous materials as defined in RCRA regulations. RCRA disposal requirements are relevant and appropriate to commingled wastes containing both chemical and radioactive materials.

The Transportation Safety Act of 1974 gave the Secretary of the DOT the authority to promulgate and enforce hazardous materials regulations for all modes of transportation, including packing, repacking, handling, labeling, marking, placarding, and routing. Key definitions which address DOT regulations concerning radioactive material are:

- Radioactive material - any material having a specific activity greater than 0.002 $\mu\text{Ci/g}$;
- Low Specific Activity (LSA) material - uranium or thorium ores and nonradioactive material externally contaminated with no more than 0.1 μCi per square cm. Specific packing requirements for LSA materials are presented in 49 CFR 173.425. A single shipment must not exceed 2,000 pCi/g for total radioactivity concentration. Packaging exceptions are given

TABLE 3-17	
MAXIMUM CONTAMINANT LIMITS (MCLs) IN PUBLIC DRINKING WATER SYSTEMS	
RADIONUCLIDE	MCL (pCi/L)
Ra-226 & Ra-228	5
Gross Alpha (excluding radon and uranium)	15
Beta-gamma emitters	4*

NOTES:

* Beta-gamma emitters limited to concentrations resulting in a 4 mrem annual dose equivalent.

Sources: 10 NYCRR Part 5-1.52; 40 CFR 141.15, 40 CFR 141.16.

TABLE 3-18			
CONCENTRATIONS LIMITS IN AIR AND WATER ABOVE NATURAL BACKGROUND FOR RADIONUCLIDES RELEVANT TO THE LI TUNGSTEN SITE			
RADIONUCLIDE		AVERAGE CONCENTRATION AIR ($\mu\text{Ci/ml}$) WATER	
^{226}Ra	S	3×10^{-12}	3×10^{-4}
	I	2×10^{-12}	3×10^{-4}
^{228}Ra	S	2×10^{-12}	3×10^{-4}
	I	1×10^{-12}	3×10^{-4}
^{230}Th	S	8×10^{-14}	2×10^{-4}
	I	3×10^{-13}	3×10^{-4}
^{232}Th	S	1×10^{-12}	2×10^{-4}
	I	1×10^{-12}	4×10^{-4}
^{234}U	S	3×10^{-12}	4×10^{-4}
	I	5×10^{-12}	4×10^{-4}
^{238}U	S	3×10^{-12}	4×10^{-4}
	I	5×10^{-12}	4×10^{-4}

NOTES:

S = Soluble

I = Insoluble

Source: 6 NYCRR Part 380.9.

TABLE 3-19			
RELEASE OF RADIONUCLIDES INTO THE SANITARY SEWER SYSTEM			
RADIONUCLIDE		DAILY/MONTHLY LIMIT ($\mu\text{Ci}/\text{ml}$)	DAILY LIMIT (μCi)
^{226}Ra	S	4×10^{-7}	0.1
	I	9×10^{-4}	0.1
^{228}Ra	S	8×10^{-7}	-
	I	7×10^{-4}	-
^{230}Th	S	5×10^{-3}	-
	I	9×10^{-4}	-
^{232}Th	S	5×10^{-3}	-
	I	1×10^{-3}	-
Th-natural*	S	6×10^{-3}	1000
	I	6×10^{-4}	1000
^{234}U	S	9×10^{-4}	0.1
	I	9×10^{-4}	0.1
^{238}U	S	1×10^{-3}	-
	I	1×10^{-3}	-
U-natural*	S	1×10^{-3}	1000
	I	1×10^{-3}	1000

NOTES:

* In equilibrium with decay products.

S = Soluble

I = Insoluble

Source: 6 NYCRR Part 380.9,10.

in 49 CFR 173.421. Limited quantities of radioactive materials are defined in 49 CFR 173.423. General design packaging requirements are outlined in 49 CFR 173.411-419.

3.2.3.3 Potential To Be Considered Materials (TBCs)

Federal TBCs

- Safe Drinking Water Act National Primary Drinking Water Regulations, Maximum Contaminant Level Goals (MCLGs).
- Proposed Maximum Contaminant Levels.
- Proposed Maximum Contaminant Levels Goals .
- Proposed Federal Air Emission Standards for Volatile Organic Control Equipment (52 Federal Register 3748) (air stripper controls).
- Proposed Requirements for Hybrid Closures (combined waste-in-place and clean closures) (52 Federal Register 8711).
- Proposed RCRA Corrective Action Criteria (40 CFR Parts 265, 270, and 271), July, 1990.
- USEPA Drinking Water Health Advisories. A numerical listing of these advisories is provided in Table 3-2.
- USEPA Health Effects Assessment (HEAs).
- TSCA Health Data.
- Toxicological Profiles, Agency for Toxic Substances and Disease Registry, U.S. Public Health Service.
- Policy for the Development of Water-Quality-Based Permit Limitations for Toxic Pollutants (49 Federal Register 9016).
- Cancer Assessment Group (National Academy of Science) Guidance.
- Groundwater Classification Guidelines.
- Groundwater Protection Strategy.
- Fish and Wildlife Coordination Act Advisories.
- Memorandum from USEPA's Office of Radiation Programs to USEPA Region II Radiation Program Branch, November 19, 1986.

- Standards for Protection Against Radiation: Final Rule (10 CFR Part 20 et al).
- DOE Order 5400.5, Radiation Protection of the Public and the Environment.
- DOE Order 5480, Hazardous and Radioactive Mixed Waste Management.
- DOE Order 5480.11, Radiation Protection For Occupational Workers.
- DOE Order 5484.1, Environmental, Safety, And Health Protection Information Reporting Requirements.
- DOE Order 5820.2, Radioactive Waste Management.
- Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material, U.S. Nuclear Regulatory Commission, 1982.
- Citizen's Guide to Radon, USEPA, 1992a.
- DOE Soil Cleanup Guidelines at Formerly Utilized Sites Remedial Action Program (FUSRAP) and Remote Surplus Facilities Management Program (RSFMP).
- Federal Drinking Water Goals, 40 CFR Part 141.

State TBCs

- New York Division of Water Technical and Operations Guidance Series (TOGS), November 15, 1991.
- NYSDEC Hazardous Waste Remediation Division Technical and Administrative Guidance Memorandum (TAGM), Draft.
- NYSDEC Proposed Petroleum Contaminated Soil Guidance.
- NYSDEC Division of Hazardous Waste Remediation Soil Cleanup Goals for Nassau County, Draft.

3.2.3.4 Potential Chemical-Specific ARAR Levels for Groundwater

Several federal and state requirements, treatment standards, goals, and guidance are established for the parameters that have been preliminarily identified in the groundwater

at the site. These criteria have been derived from drinking water and aquifer protection programs, corrective action programs, and health/risk-based determinations. As enumerated in the Nassau County Sewer Ordinance, dated June 1985, groundwater is prohibited from being discharged into any of the County's sanitary sewers. Therefore, ARARs associated with discharge to any Nassau County Publicly Owned Treatment Works (POTW) have not been included.

The New York State Water Quality Regulations - Groundwater Classifications and Standards for aquifer classification GA, (6 NYCRR Part 703.5), are used to protect human health and the environment. These standards, determined to be appropriate requirements for this site, identify Class GA groundwater as fresh groundwater within the unconsolidated zone or consolidated rock or bedrock that is suitable as a potable water supply source. Section 703.5(a) provides standards for some of the contaminants found in the groundwater at this site based on the GA classification. Section 703.5(a)(3) does not provide standards for specific contaminants, however, Section 703.5(a)(2) requires the use of the state Maximum Contaminant Level (MCL).

The New York State Sanitary Code for Drinking Water Supplies (10 NYCRR Subpart 5-1) provides standards for the treatment of New York State groundwater and surface water for public potable water supplies. The state has established MCLs for public potable water supplies. These state MCLs are required under the groundwater standards described above. Most of the MCLs are chemical-specific ARARs for each of the contaminants of concern identified in this Work Plan.

The federal Safe Drinking Water Act MCLs provide standards for the treatment of groundwater and surface water for public potable water supplies. These standards are relevant and applicable requirements for this site. All but one of these standards are the same as or less stringent than the New York groundwater and MCL standards described above. The federal MCL for total phthalates of 4 $\mu\text{g/L}$ is more stringent than the state MCL for an unspecified organic contaminant concentration of 50 $\mu\text{g/L}$.

Groundwater TBCs are derived from three sources: NYSDEC Division of Water Technical Operational Guidance Series (TOGS) water quality guidance values, the proposed federal

RCRA Corrective Action Rule values, and federal MCLGs. The NYSDEC TOGS memorandum, dated September 25, 1990, provides a compilation of water quality guidance concentrations for toxic and non-conventional pollutants to be used in New York regulatory programs in lieu of promulgated standards. TBCs derived from these above-mentioned sources will be considered as part of the FS during the selection of remedial technologies.

3.2.4 Preliminary Scoping of ARAR Impacts

ARARs (and TBCs necessary for protection) must be attained for hazardous substances, pollutants, or contaminants remaining on-site at the completion of the remedial action (unless waiver of an ARAR is justified). In addition, implementation of remedial actions shall also comply with ARARs (and TBCs as appropriate) to protect public health and the environment. ARARs (and TBCs necessary for protection), pertaining both to contaminant levels and to performance or design standards, should generally be attained at all points of potential exposure, or at the point specified by the ARAR itself.

ARARs (and TBCs necessary for protection) therefore define the universe of probable remedies since only a remedy which meets ARARs (both in its application and in its results) can be chosen. The ARARs will impact the development of remedial alternatives which address potential cleanup levels and the attainment of specific environmental standards.

Key ARARs for remediation of contaminated water will be those that address the MCLs or other drinking water standards. Where there are no ARAR's for some of the compounds present, TBCs will be taken into account. NYSDEC soil cleanup TBCs will be considered where the soils are shown to be contaminated during the RI.

ARARs that may limit the applicability of a potential alternative at the site include the RCRA Land Disposal Restriction for soil or waste excavation and off-site disposal, and the National Historic Preservation Act (NHPA). The NHPA affords the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation an opportunity to comment on the proposed remedial activities and their potential effects. The purpose of the NHPA Section 106 process is to incorporate historic preservation concerns with the needs of the federal action. It is designed to identify potential adverse effects that

could occur and to offer ways to mitigate these effects. Consultation among the SHPO and other interested persons during the remedial design activities is encouraged.

Portions of the area may be subject to the National Historic Preservation Act of 1966. Section 106 requires a federal agency to "take into account" how its actions could affect historic properties. It affords the SHPO and the Advisory Council on Historic Preservation an opportunity to comment on the proposed remedial activities and their potential effects.

The purpose of the Section 106 process is to incorporate historic preservation concerns with the needs of the federal action. It is designed to identify potential adverse effects that could occur and to offer ways to mitigate these effects. Consultation among the SHPO and other interested persons during the remedial design activities is encouraged.

3.3 PRELIMINARY RISK ASSESSMENT

This section presents a preliminary assessment of the potential human health risks associated with the site. The preliminary assessment provides the basis for the sampling and analysis programs described in this Work Plan. This assessment is based upon information gathered to date relating to the distribution and concentrations of contaminants, site history, land use, demography, hydrogeology and other data presented in this Work Plan.

3.3.1 Potential Chemicals of Concern

The risk assessment will address both chemical and radionuclide hazards associated with the site. The preliminary list of compounds that pose a potential risk to human health are listed in Table 3-20 according to their environmental matrices. These compounds were selected based upon preliminary review of the existing contamination pathways data using the following criteria:

- Measured concentration relative to background levels and/or relevant
- Toxicity
- Availability of toxicological criteria
- Frequency of detection

TABLE 3-20
PRELIMINARY LIST OF
CHEMICALS OF POTENTIAL CONCERN
BY ENVIRONMENTAL MEDIUM

	GROUND WATER	SOIL	SURFACE WATER	SEDIMENT
VOLATILE ORGANIC COMPOUNDS				
Benzene	X			
Chloroethane	X			
Dichloroethane, 1,1-	X			
Dichloroethane, 1,2-	X			
Dichloroethene, 1,1-	X			
Dichloroethene, 1,2-	X			
Dichloroethene, trans 1,2-	X		X	
Ethyl Benzene	X			
Tetrachloroethene	X		X	
Trichloroethane, 1,1,1-	X			
Trichloroethane, 1,1,2-			X	
Trichloroethene	X		X	X
Vinyl Chloride	X			
SEMI-VOLATILE ORGANIC COMPOUNDS				
Benzoic Acid		X		X
Bis(2-Ethylhexyl) Phthalate		X		X
Buryl Benzyl Phthalate				X
Di-n-Octyl Phthalate				X
PAHs		X		X
PESTICIDES/PCBs				
DDE/DDD/DDT		X	X	X
PCBs		X	X	X
INORGANICS				
Antimony	X	X	X	X
Arsenic	X	X		X
Barium	X			
Beryllium	X	X		
Cadmium	X	X	X	
Chromium	X	X	X	
Cobalt	X	X	X	
Copper	X	X	X	X
Cyanide	X	X		
Lead	X	X	X	X
Manganese	X	X	X	X
Mercury	X	X		X
Nickel	X	X	X	X
Tungsten	X	X	X	X
Vanadium	X			
Zinc	X		X	
RADIONUCLIDES				
Radium	X	X		X
Thorium	X	X		X
Uranium	X	X		X

- Site history.

This selection was based on an evaluation of currently available analytical data, and a review of the site history. Further sampling and analysis to be performed in the RI as described in Section 5.3 will refine the selection of chemicals of potential concern. Exposure to these chemicals via different pathways will be evaluated in the RI. Exposure pathways considered to be of potential significance are discussed in Subsection 3.3.3.

3.3.2 Potential Source Areas and Release Mechanisms

Interim remedial actions (IRAs) have been proposed to remove imminent site safety hazards prior to initiation of the RI. As the site now exists, there are a number of contaminant source areas. The source areas which have been identified for removal as part of an IRA effort, include:

- drums and crates of radioactive process ore, residual byproducts and slag;
- friable asbestos pipe insulation, tank covers, wallboard, shingles.

Additionally, walls and roofs of structurally deficient buildings will be demolished, where necessary, to permit safe access for RI activities. Access will be restricted from other areas deemed to be hazardous. If the IRAs are conducted as planned, any residuals from these sources would be considered secondary sources (e.g., leaks and spills) in the risk assessment.

Remaining primary sources of contamination at the Li Tungsten site are:

- disposal areas/radioactive fill;
- surface impoundments;
- underground storage tanks (location/condition unknown)/above-ground fuel oil tank;
- disposal area in Parcel B.

There have been past releases and spills which have contributed to soil contamination, which

can be considered as secondary sources. Another secondary source is off-site groundwater contamination arising from neighboring commercial/industrial operations.

Infiltration and percolation through the soils to groundwater and surface waters are primary release mechanisms of site contaminants. Surface runoff, and discharge through stormwater drains and process sewers are also likely release mechanisms from the site.

3.3.3 Potential Exposure Pathways and Receptors

Should the IRA effort not proceed, and the RI activities begin with these hazards in place, there are a number of potential exposure pathways, including the potential for contact by: (1) trespassers entering the site for salvage; and (2) legitimate site entrants to the following hazardous conditions:

- physical safety hazards (e.g., there are approximately 8,000 drums inside and outside buildings, some disintegrated, corroded or bulging, stacked on pallets, some precariously perched; Parcels A and C have buildings with collapsed roofs, damaged chimneys, deteriorated overhangs, floor openings, missing floor gratings, ponded water concealing pits; questionable integrity of structures, facilities, tanks and buildings; slip/trip hazards; and a bulkhead area of unknown structural integrity)
- radioactive materials, including slag inside West Dice Building
- friable asbestos
- hydrofluoric acid in drums.

Because of the imminent nature of the safety hazards existing on-site, there is serious urgency in implementing the IRAs prior to beginning the RI.

Assuming the IRA effort has removed imminent hazards including the primary source areas identified in the initial list in Section 3.3.2, under a current use scenario, there is the potential for trespassers and legitimate site entrants to encounter:

- residual radioactive and chemical contamination of buildings and environmental media

- contaminants in the surface impoundments, waste piles, other disposal areas
- mercury reduction in the Reduction (Benbow) Building subfloor conduit (if heavy equipment is removed)
- leachate, contaminated soil.

Under future conditions, authorized and unauthorized individuals may continue to be exposed to site conditions as described above. Additionally, there is the potential that site contamination may spread off-site to Glen Cove Creek, Hempstead Harbor, and offsite water supply wells. In this instance, additional receptors and exposure pathways may include:

- residents who may become exposed to contaminants during recreational use of nearby Hempstead Harbor beaches because of off-site migration to surface waters,
 - via stormwater runoff (e.g., from the disposal area in Parcel B, Mud Pond/Mud Holes, spills/releases in soils);
 - via percolation/infiltration from surface impoundments on-site (e.g., two unlined settling ponds (Mud Holes), lined settling pond (Mud Ponds);
 - via storm drains (e.g., in Herb Hill Road), process sewers and floor drains;
 - via groundwater flow to Glen Cove Creek.
- consumers of fish (e.g., flounder, fluke, bluefish) from Hempstead Harbor which may become contaminated by the site.
- residents and workers whose groundwater use consists of:
 - private drinking water;
 - public supply;
 - commercial, industrial wells for process use;
 - irrigation.

No enhanced levels of radionuclides were detected previously in the Creek. There are a number of off-site sources which may be contributing to degradation of water quality in Glen Cove Creek and Hempstead Harbor, and some of these will also be undergoing RI activities during the same time, with a focus on effects on the Creek and Harbor. These efforts will be discussed in the Li Tungsten human health risk assessment as part of the evaluation of the potential site impact on the Creek and Harbor.

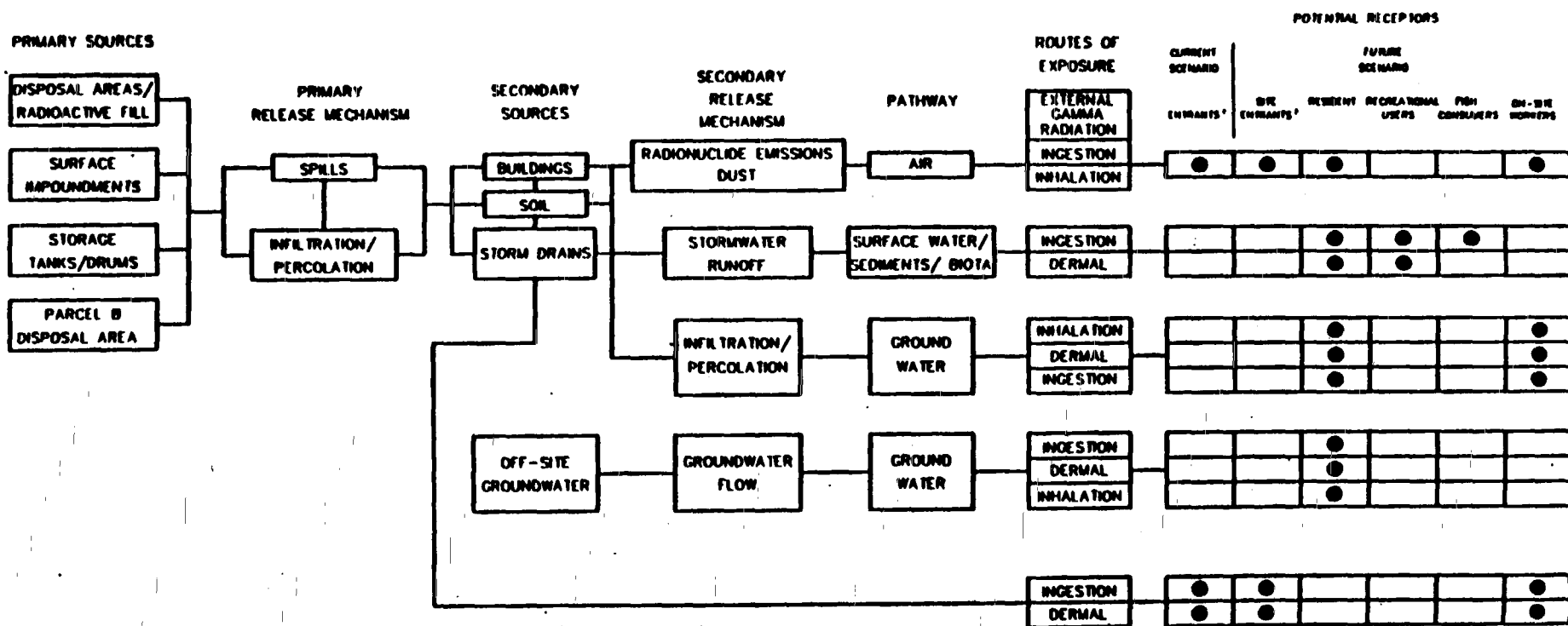
An evaluation of site impacts on active recreational use of Hempstead Harbor beaches is appropriate. The New York State water quality classification for Hempstead Harbor north of Bar Beach is Class SA, permitting the collection of shellfish for market purposes, and primary/secondary recreation. Primary contact recreation consists of such activities as swimming, diving, water skiing and skin diving, where direct contact may occur.

A more limited evaluation of the impact of the site on recreational use of Glen Cove Creek is warranted. It is classified as Class 1, permitting secondary contact recreation, consisting of such activities as fishing and boating, where contact with water is minimal and ingestion of water is not probable.

Water supply wells may become affected by off-site migration of site contaminants. The RI will include an inventory of surrounding wells and their current status. Reportedly, there are public water supply wells in nearby Glen Cove, Sea Cliff and Locust Valley. There are eight water supply wells tapping the Upper Glacial aquifer, which is classified as a sole source aquifer, within a three-mile radius. Additionally, there are six public water supply wells within the Lloyd Sand aquifer, which is also a sole source aquifer. According to the Nassau County Department of Health, Water Supply Division, no private drinking water wells are known to be in operation in the vicinity of Glen Cove; all residences and business are believed to be connected to public water supply systems. Other private wells in the area are used for industrial purposes only. This information will be confirmed during the RI prior to identifying the most likely location of downgradient wells which may become impacted by site contamination and may affect the user population, potentially consisting of residents and workers.

3.3.4 Potential Conceptual Site Model

A conceptual model for potential human exposure to the contaminants found at the Li Tungsten site is shown in Figure 3-3. This model is based on the assumption that imminent site safety and health hazards have been removed prior to implementation of remedial action objectives. As indicated, primary sources of contamination include disposal areas and radioactive fill, surface impoundments, storage tanks and drums, and the Parcel B disposal area. Releases from these areas may occur by spillage, infiltration and percolation, both



NOTES:

CONCEPTUAL SITE MODEL IS BASED ON THE ASSUMPTION THAT THE PROPOSED INTERM REMEDIAL ACTIONS WILL REMOVE IMMEDIATE SITE SAFETY/HEALTH HAZARDS (SEE SECTION 3.7).

* AUTHORIZED AND UNAUTHORIZED (E.G., FIREFIGHTERS, TRESPASSERS).

within buildings and to soil and storm drains. Contaminants may be further released by the emission of radionuclide dust to the air, transfer via stormwater runoff to surface water, sediments and biota, or via infiltration and percolation to groundwater. Further, this model includes a potential contribution by off-site sources which may lead to contaminated groundwater on the property. Exposure of human and biota receptors to site-related contamination may occur via ingestion, inhalation and dermal contact. Human exposure may also occur via ingestion of contaminated fish and shellfish.

3.4 SUMMARY OF ADDITIONAL DATA NEEDS

Additional data are needed to further characterize the nature and extent of contamination. This can be accomplished through strategic sampling and analyses of air, soil, groundwater, surface water and sediment. Recommendations include:

- Radiological sampling of environmental media, equipment, tank residues and structural components of buildings.
- Inclusion of tungsten and other unusual analytes which are associated with the site history, as analytical parameters.
- Sediment sampling in Glen Cove Creek for chemical and radionuclide contamination, surface water sampling for chemical contamination. The sampling program should be so designed to differentiate contamination resulting from Li Tungsten and that from other sites.
- Contamination levels investigated in both the Upper Glacial and Lloyd Sand Aquifers. Locations should be chosen to determine the existence, nature and extent of contaminant plumes in groundwater. Groundwater modeling may be required in order to evaluate the future impact on drinking water supplies.
- An inventory of groundwater uses in the vicinity of the site.
- An inventory of surface water uses in the vicinity of the site to be used in a qualitative assessment of site impacts on fish and shellfish resources/use.

3.5 IDENTIFICATION OF PRELIMINARY REMEDIAL ACTION OBJECTIVES

Section 121(b) of CERCLA exhibits a preference for remedial actions in which treatment permanently and significantly reduces the volume, toxicity or mobility of the hazardous

substances, pollutants, and contaminants. The remedial action must be protective of human health and the environment, cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The purpose of this section of the Work Plan is to identify potential remedial action objectives for each contaminated medium and a preliminary range of remedial action alternatives and associated technologies. It is a general classification of potential remedial actions based upon the initially identified potential routes of exposure and associated receptors identified in Section 3.3.

3.5.1 Preliminary Objectives

The RI will address four media - soils, groundwater, sediments, and surface water. Preliminary remedial action objectives for these media include the following:

Soils

- Prevent exposure (ingestion, direct contact or inhalation) to soil with contaminant concentrations exceeding risk-based levels developed in the Risk Assessment.
- Prevent migration of contaminants that would result in groundwater or surface water concentrations exceeding the risk-based levels developed in the Risk Assessment.

Groundwater

- Prevent ingestion of water having contaminant concentrations in excess of the risk-based levels developed in the Risk Assessment.
- Mitigate further migration of water having contaminants in excess of the risk-based levels developed in the Risk Assessment.
- Clean up groundwater such that available ARARs and risk-based levels are attained at the end of the remedy.

Sediments

- Prevent direct contact with sediments or fauna from sediments with contaminant concentrations exceeding risk-based levels developed in Risk Assessment.

- Prevent release of contaminants from sediments to surface water in quantities that would exceed the risk-based levels developed in the Risk Assessment.

Surface Water

- Prevent ingestion of surface water having contaminant concentrations in excess of the risk-based levels developed in the Risk Assessment.
- Remediate surface water such that available ARARs and risk-based levels developed in the Risk Assessment are attained at the end of the remedy.

3.5.2 Preliminary Response Actions, Remedial Technologies and Alternatives

To meet the above preliminary remedial action objectives, a set of general response actions were identified. These general response actions identify the areas to be investigated to meet objectives and fall into the following categories:

- No action
- Limited Action
- Containment
- Removal
- Treatment

Listed below is a preliminary list of alternatives intended to provide a wide range of alternatives as a starting point for the FS, which involves the development, screening and detailed analysis of alternatives discussed in Section 5.10. Further investigations into alternatives will utilize the appropriate USEPA guidance document (USEPA, 1988d) as well as other source documents.

3.5.2.1 Soil Treatment and Disposal

The contaminated soil at the site can be remediated by either excavation and on-site or off-site treatment/disposal, or in situ treatment as discussed below. These alternatives would entail the treatment of contaminated soils to reduce or eliminate their potential risk to public health and the environment.

- On-site or off-site treatment/disposal

On-site/off-site treatment technologies may include soil washing, incineration, mechanical (thermal) aeration, chemical fixation, chemical or biological treatment and roasting. The treated soil would be disposed of either by landfilling off site or by use as backfill on site.

Soil washing involves chemical and physical processes. The chemical process applies solvent or water extraction methodologies to remove contaminants (metals and organics) from the soil. Physical processes may include classification of the contaminated soil prior to extraction, removal of excess moisture from treated soil after extraction, and recovery of the spent extraction fluids. The waste water generated from soil washing would be treated in an on-site water treatment system.

Soil incineration is a process in which one of a number of thermal technologies is utilized to accomplish different phases of thermal reactions leading progressively to the complete oxidation of organic substances.

Thermal aeration involves the contact of clean air with the heated, contaminated soils to transfer the volatile organics from the soil into the air system. Depending upon the concentrations of contaminants, the air stream could be combusted in an afterburner or passed through activated carbon for air pollution control.

Chemical fixation involves the addition of siliceous material combined with setting agents, such as lime or cement, resulting in a stabilized and solidified product. Commercial proprietary fixation agents and processes can be used for both inorganic and organic contaminated soils.

The biological treatment technology considered for the contaminated soil is the so-called "land farming" technology, which involves spreading contaminated soil over a prepared treatment area. Depending on the characteristics of the contaminated soil, it could be mixed with nutrient-enriched soil. The moisture, carbon/nitrogen ratio, pH and nutrient content of the soil are monitored and maintained to enhance the microbial metabolism. The hazardous organics would thus be degraded and transformed to nonhazardous substances. This technology is unlikely to be applicable at this site.

Roasting is a treatment process that can immobilize the contaminant metals in soils by incorporating them into a ceramic-like matrix. This process involves heating the metal-contaminated soil along with an additive (e.g., kaolin) in a rotary kiln or multiple-hearth furnace. The operating temperature is generally two-thirds of the metal's melting temperature.

In Situ Treatment

Technologies capable of treating contaminated soil in-place have been considered. These technologies include soil flushing, vitrification, and solidification.

Soil flushing is the in-place washing of contaminants from the soil with a suitable solvent such as steam, water or a surfactant solution. The contaminated elutriate is pumped to the surface for removal, resource recovery and recirculation, or on-site treatment and reinjection.

The *in situ* soil vitrification technology uses an electric current passed between electrodes placed in the ground to convert soil and contaminants into a stable glass material. Heat from the electric current decomposes organic matter, and solubilizes and encapsulates metallic and other inorganic materials in the vitrified mass. When the electric current ceases, the molten mass cools and solidifies. The gases generated from vitrification can be further combusted in an afterburner for air pollution control. Any wastewater generated from scrubbing gaseous emissions can be treated in an on-site water treatment system.

In situ solidification uses a mechanical mixer/injector to introduce and mix fixation materials directly into the contaminated subsurface materials. The soil is eventually solidified.

3.5.2.2 Groundwater Treatment and Disposal

The contaminated groundwater at the site can be pumped and treated on-site or treated *in situ* as discussed below. USEPA guidance (USEPA, 1988e) provides further information on

groundwater remediation strategies and technologies.

On-Site Treatment/Disposal

On-site treatment technologies involve air stripping, carbon adsorption or chemical oxidation for removing volatile organics; and carbon adsorption, chemical oxidation biological treatment, chemical precipitation/or exchange, and reverse osmosis for removing nonvolatile organics.

Air stripping is a mass transfer process in which volatile organic contaminants in groundwater are transferred to the gaseous vapor phase. Generally organic compounds with a Henry's Law constant of greater than 0.003 can be effectively removed by air stripping. Air stripping is an efficient process to treat aqueous groundwater with relatively high volatility, low water solubility organic contamination (e.g., chlorinated hydrocarbons such as tetrachloroethylene) and aromatics (such as toluene).

The process of adsorption onto activated carbon involves contacting a waste stream with the carbon, usually by flow through a series of packed or packed bed reactors. The activated carbon selectively adsorbs hazardous constituents in the waste by a surface attraction phenomenon, in which the organic molecules are attracted to the internal pore surfaces of the carbon granules. Activated carbon can be used for the adsorption of volatile and semivolatile organic contaminants of the groundwater.

If the RI results indicate that the groundwater is contaminated with metals, chemical precipitation or ion exchange can be used to remove the metals. Chemical precipitation is a pH adjustment process in which acid or base is added to a solution to adjust the pH to a point where the constituents have their lowest solubility. Metals can be precipitated from solution as hydroxides, sulfides, carbonates or other insoluble salts. Hydroxide precipitation with lime is most common, however, sodium sulfide is sometimes used to achieve lower concentrations of metal in the treatment effluent. The resulting residuals are metal sludge and the treatment effluent, which has an elevated pH and (in the case of sulfide precipitation) excess sulfides. Ion exchange is a process whereby selective ions are removed

from the aqueous phase by less harmful ions held by ion exchange resins.

Reverse osmosis can be used to remove dissolved solids, including sodium, to meet drinking water standards. In normal osmotic processes, solvent will flow across a semipermeable membrane from a dilute concentration to a more concentrated solution until equilibrium is reached. The application of high pressure to the concentrated side will cause this process to reverse. This results in solvent flow away from the concentrated solution, leaving an even higher concentration of solute.

3.5.2.3 Underground Tanks

The tanks at the site can be excavated and handled by either on-site treatment/disposal or off-site treatment/disposal.

A definitive location of the tanks and a characterization of their contents are needed during the investigation. The selection of treatment methods will be based on the RI results, which will define the nature and quantity of the wastes and chemicals.

3.5.2.4 Buildings/Structures

Technologies capable of treating contaminated structures have been considered for preliminary evaluation. These technologies include vacuuming, solvent washing, steam cleaning, painting and coating (sealing) and gritblasting.

Vacuuming is used to remove loose particulate contamination from surfaces of structures by common cleaning techniques. This technology is generally used in conjunction with other technologies.

Gritblasting is a surface removal technique in which an abrasive material is used for the uniform removal of contaminated surface layers from buildings. Hydroblasting uses a high-pressure water jet to remove contaminated debris from surfaces.

Solvent washing technology consists of pressure-spraying fluorocarbon solvents (e.g., Freon).

113) onto contaminated surfaces, followed by the collection and purification of the solvent.

Steam cleaning uses steam in place of solvent but is only designed to remove surface contamination.

Surface sealing is a painting process in which appropriate resin types are coated onto the surface to contain the contaminants within the structure.

3.6 NEED FOR TREATABILITY STUDIES

At this time the existing site data does not suggest the need for a treatability study. If during the course of the RI, it becomes evident that a treatability study will be necessary, the USEPA will be notified and a separate Treatability Study Work Plan will be prepared and submitted. Additional details on the components of a treatability study, if required, are discussed in Section 5.7.

3.7 INTERIM REMEDIAL ACTIONS (IRA)

Interim remedial actions proposed in this section of the Work Plan are recommended before any RI field investigation tasks are initiated. This section is not intended to serve as a work plan for implementation of the interim remedial actions, but only to enumerate the various components of each task. A separate IRA Work Plan and Health and Safety Plan will be prepared by the selected contractor performing the activity.

In general, the activities have been divided into two categories: pre-planning activities and cleanup activities. The pre-planning tasks should be performed in the order in which they are enumerated, whereas the clean-up tasks can be performed in any order. Specific tasks in each category should include but not be limited to those listed below:

PRE-PLANNING ACTIVITIES

Emergency Issues

- List all emergency telephone numbers [Emergency Medical Service (EMS), hospital, police, fire, etc.]
- Formulate evacuation plan showing routes of escape, directions to hospital, etc.
- Establish site safety and security person contacts and site emergency person contacts. List clear chain of command with telephone numbers.
- Review site records, waste inventories, previous sampling and monitoring data.
- Plan and identify areas for segregation of waste, usable products and decontamination.
- Provide emergency first aid kits, eye washes and decontamination water to site.

Access for Inspection

- Clear out pathways and routes for inspector access to structures and facilities.
- Use workers with hand tools in preference to construction equipment to avoid excessive vibration and load stressing.
- Inspect exits. Assure they are sound and useable.

Inspection

- Engineer to inspect and evaluate integrity of structures, facilities, tanks, and buildings before entry is made by workers and construction equipment. Use Structural Engineer. Mark off unsafe areas.
- After evaluation of structural integrity, inspect facilities for asbestos containing material (ACM). Use certified asbestos inspector, mark off unsafe areas.
- Monitor for radiation, toxics/flammables, stressed vegetation areas, and hot spots. Use radiation safety officer and health/safety specialists. Mark off unsafe areas.
- Determine where live electrical conductors, overhead lines, power circuits, or equipment, are alive and proximity to work tasks. Use electrician or knowledgeable technician/engineer or verify with Long

Island Lighting Company (LILCO).

Major Access

- Using trained and certified construction equipment operators, clear major access pathways and walkways of debris and overgrowth. Use care to avoid areas containing unsafe buildings, structures, tanks, facilities, radiation, asbestos and other marked off areas.

CLEAN-UP ACTIVITIES

Structural Integrity of Buildings

- After engineering evaluation, install barriers, barrier tape and signs around those found to be unsound, as appropriate.
- Inspect and remove, demolish or correct imminent dangers to structures as: collapsed roofs; damaged chimneys, deteriorated overhangs; windows on verge of falling; floor openings; missing floor gratings and covers; floors with insufficient load ratings; roadway crossover bridge/pathways.
- Pre-test for integrity or avoid using: floors and surface areas used as staging areas; areas stressed by additional loading or vibration caused by use of construction equipment.
- Check integrity of steel uprights and concrete blocks where spillage, water submergence, and chemical contact of products occurred through the years.

Physical Obstructions

- Removal contractor to keep all roadways and passageways free of debris.
- Contractor to supply and keep on site sufficient numbers of rolloff waste containers and receptacles.
- Implement daily clean-up of debris and frequent emptying of waste containers/receptacles.
- In-use and parked construction equipment/machinery shall not block

emergency egress roadways and pathways.

- Stability of terrain to be maintained at all times during removal work tasks.

Radiation

- Determine volume estimates and radiological/hazardous waste characterization of above ground piles of waste (e.g., processed, partially processed, and slag) through visual inspection, surface radiation measurements, and selective sampling (e.g. thorium concentration, TCLP, etc. as necessary).
- Arrange for disposal or reclamation of unprocessed and processed tungsten ore according to radiological and/or hazardous waste determination.
- Oversee removal operations for conformity with regulations.

Tanks, Hoppers, Vessels, Pipelines

- Identify products and residues in tanks, vessels, hoppers and pipelines.
- If entry must be made, and if classified as a confined space, implement all confined space entry regulations.
- De-energize all sources of energy before dismantling or entry, e.g.: pneumatic; hydraulic; electrical; mechanical; chemical; thermal; and gravity. De-energize all associated piping connected to tanks, vessels and hoppers.
- Clean and purge small tanks and containers per NFPA 327.
- Tank and vessel preparation prior to oxy-fuel burning/cutting operations should conform to accepted National Safety Council methods.
- Tank/vessel remnants to be removed from site as soon as feasible and not block emergency egress or access roads.
- Tanks outside Carbide Buildings - Strapping encircling tanks may be under stress or tension. Extreme caution necessary when removing due to potential for recoil into worker or equipment.

Drums and Crates

- Screen drums, crates and spillage for radiation, toxic and flammable hazards.
- Remove, segregate and unstack hazardous waste drums and crates. Do not re-stack. Use new pallets, plastic liner and barrier fence with appropriate warning/danger signs.
- Unstack and segregate drums and crates which are disintegrated, corroded and bulging. Do not re-stack. Use plastic liner and barrier fence with appropriate warning/danger signs.
- Unstack and segregate drums and crates which appear to be in sound condition in separate staging area onto sound pallets. Use appropriate signage.
- Cover all exposed waste piles with plastic above and below. Use appropriate signage.

Demolition Tasks (If Applicable)

- Pre-plan methods to be used to bring the structure down, considering adjacent structure.
- Perform engineering survey.
- Install barriers around holes, ditches and excavations.
- Demolition tasks for burning and cutting will include:
 - a) Hot Works Permits.
 - b) Fire Watch.
 - c) Removal of combustibles from area, or covering them with sheet metal or other non-combustible material.
 - d) Safe storage of fuel gas and oxygen cylinders.
 - e) Avoidance of hot metal slag falling through floor cracks and crevices.
 - f) Use of welding curtains where applicable and feasible.
 - g) Preliminary wetting down of working area with water.
- Where explosives and blasting are used during demolition:
 - a) Only authorized and qualified persons are to handle and use explosives.
 - b) Provide approved and locked magazines for storage of

- c) explosives.
 - d) Avoid smoking and open flames within 50 feet of explosives and storage magazines.
 - e) Postpone blasting operations at the approach of and during electrical storms.
 - e) Pay attention to blasting warning signs and signals.
- PCBs if present in fluorescent light fixture ballasts will be disposed of as required.

Slip, Trip, Fall Hazards

- Install steel plates over holes in floors, roadways and walkways.
- Refill holes and undermined areas.
- Remove standing water and improperly drained areas which may cause slick or slippery surfaces.
- Remove, replace or shore up unsound railings and guards at platforms and upper elevated areas.
- Remove damaged floor gratings and plates. Repair or replace. Ensure stable placement of gratings, plates and manhole covers.

Asbestos

- Certified inspector to delineate facilities and areas to avoid until asbestos removal contract is in effect.
- Contract to an asbestos removal firm.
- Oversee asbestos removal operations for conformity with regulations.

Spill

- After removal of heavy equipment, complete removal of mercury in laboratory using methodology previously developed (HART, 1990).

Miscellaneous

- Inspect and evaluate undermining and unstable pier, dock and bulkhead area.
- Pier and dock area to be fortified, if necessary, to withstand heavy

construction equipment.

- Assure outside lighting is sufficient for construction tasks during shortened winter daylight activities.
- If overhead electrical lines are live, ensure operating construction machinery remains at least 10 feet distance at all times.
- Provide inside emergency lighting.
- Monitor, sample and evaluate gases, vapors and residues in HVAC areas.

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4.0 WORK PLAN RATIONALE

4.1 Data Quality Objectives (DQO)

Data Quality Objectives (DQOs) for the RI/FS are qualitative and quantitative statements which specify the quality of data necessary to support determinations on:

- the nature and extent of contamination (e.g., distribution and migration/fate and transport);
- the risks posed by the contamination (e.g., human health and ecological), and
- remedial alternative evaluations (e.g., compliance with ARARs, reduction of toxicity and mobility).

DQOs ensure that the quality of data for particular RI/FS activities are acceptable for the intended use of the data and also ensure precision, accuracy, reproducibility, comparability, and completeness.

The analytical DQO levels are defined as follows:

- Level I - field screening or analysis using portable instruments. Results are often not compound-specific and not quantitative, but results are available in real-time. It is the least costly of the analytical options.
- Level II - field analysis using more sophisticated portable analytical instruments; in some cases, the instruments may be set up in a mobile laboratory on-site. There is a wide range in the quality of data that can be generated. It depends on the use of the calibration standards, reference materials, sample preparation equipment, and the training of the operator. Results are available in real-time or several hours.
- Level III - analyses performed in an off-site analytical laboratory that may or may not use CLP procedures, but do not usually utilize the validation or documentation procedures required of CLP Level IV analyses. The laboratory may or may not be a CLP laboratory.

- Level IV - CLP routine analytical services (RAS). Analyses are performed in an off-site CLP laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation.
- Level V - analysis by non-standard methods. Analyses are performed in an off-site analytical laboratory which may or may not be a CLP laboratory. Method development or modification may be required for specific constituents or detection limits. CLP special analytical services (SAS) are Level V.

The purpose of this Section is to provide the DQOs deemed necessary for this RI/FS project based upon evaluation of existing site data, the preliminarily defined ARARs, human health and ecological risks, and remedial action objectives, as identified in Section 3.0 of this Work Plan. Refinements to the DQOs may become necessary as this RI/FS project progresses and will be in accordance with the guidance document for DQOs (USEPA, 1987a).

Based upon review of the analytical methods, the data collected as part the SI investigation (NUS, 1990) are Level IV data. The analytical data collected by others between 1987 and 1990 (G&M, 1988; RTP, 1988; NDL, 1989; HART, 1990), however, are reported without reference to the method. Level III analytical data are generally used for site characterization purposes, however, they may only be used to evaluate risk and remedial alternatives if accompanied by adequate QA/QC procedures. A brief effort will be made to determine the analytical data level for these data so that they made be included in the database for the site.

To achieve the objectives of the Li Tungsten RI/FS, field investigations will be undertaken which will generate Levels I, IV and V analytical data. Previously collected Level IV data will also be evaluated as discussed above. Level II and III analyses are not planned during the RI/FS (except for any treatability studies that may be performed). Where data have multiple uses, the uses are prioritized and assigned the highest analytical level for a particular use. Only the highest analytical uses are discussed below.

The Level I data to be generated include field OVA or HNu and gamma radiation exposure rate readings gathered during the health and safety monitoring of the field activities. These are real-

time data used for the immediate evaluation of field conditions. Field measurements of parameters such as pH, temperature and specific conductance of water samples are also examples of Level I data which will be collected at the site. These real-time data will be collected to permit immediate evaluation of the adequacy of monitoring well purging. Monitoring wells will be installed to provide data regarding the hydraulic characteristics and chemical quality of water-bearing zones at the site.

Previous soil sampling conducted at the site which has identified contamination has been limited. Additional sampling must, therefore, be performed to define the extent of contamination. Previously conducted on-site ground water sampling which identified contamination from both on-site and off-site sources, was limited to the shallow ground water zone. Additional monitoring wells must be installed to provide sampling points to further investigate the horizontal and vertical extent of ground water contamination. Previous sampling indicates the sediment and the surface water is contaminated. Additional sampling is needed to determine if this contamination is impacting downstream water bodies.

4.2 Work Plan Approach

The objectives of the Li Tungsten RI/FS were developed based on the available data (G&M, 1988; RTP, 1988; NDL, 1989; HART, 1990; and NUS, 1989; 1990). Information was also compiled from published reports on regional and local geology and hydrogeology and a site visit. Additionally, much of the information and results of the RI activities at the Mattiace Petrochemical site were also incorporated into this Work Plan. The Li Tungsten site is immediately adjacent to the Mattiace site and experiences gained at Mattiace have been considered and accounted for in the development of the Task 103 (Section 5.3), Field Investigations.

The first objective of the RI is to characterize the nature and extent of contamination and to estimate ground water flow patterns as well as other patterns of contaminant migration.

The recommended overall approach to conducting this RI includes:

- Evaluation of existing data (Section 3.1 of this Work Plan);

- Determination of additional data needs and data quality objectives;
- Data collection activities;
- Sample analysis and validation;
- Data evaluation;
- Determination on necessity for additional data/treatability studies;
- Risk Assessment; and
- Report.

Uncertainties relate primarily to contamination not detected as part of this RI. Conceivably, contaminated areas can be missed on a large site unless significant efforts, cost and time are spent to investigate the site in great detail. To achieve the objectives of the RI, and to meet the data needs as presented in Section 3.4, the RI activities proposed as follows:

Radiological Survey - to be conducted in two phases. Phase I will consist of a gamma exposure rate survey after the processed and unprocessed tungsten ore and residual byproducts are removed, and short-term radon/thoron measurements. Based on the results of the Phase I survey, Phase II activities will consist of surface alpha measurements, gamma logging of soil borings, gamma surveys of buildings, analysis of soil, surface water and ground water samples for radionuclides.

Topographic Mapping - to enable accurate determination of ground water elevation and flow direction.

Geophysical Survey - a limited magnetometer survey will be conducted to provide information on the potential for buried drums in the landfill on Parcel B and in determining the location of underground storage tanks.

Test Pits - a series of shallow test pits will be dug around the perimeter of the landfill in Parcel B to delineate the extent of waste and to physically and chemically characterize the waste and

surrounding soil.

Soils Investigation - will consist of soil borings in the landfill (Parcel B), along the alignment of the storm drains, and for site-specific information on stratigraphy (e.g., presence and depth to clay layer). Selected soil samples will be collected and analyzed for chemical, radiological, and physical parameters.

Surface Water and Sediment - surface water and sediment samples will be collected from both natural and manmade surface water bodies on the site (e.g., the unnamed pond and drainage channel on Parcel C, Mud Pond, and the oil recovery sumps and wastewater retention tank on Parcel A).

Hydrogeologic Investigation - new monitoring wells will be installed across the site, ground water samples will be collected and analyzed to characterize the extent of ground water contamination at the site. Ground water and surface water levels will be measured to determine ground water flow directions and if the surface water bodies are recharge or discharge points for ground water. A pumping test will be conducted to measure aquifer parameters and determine hydraulic connection with potential off-site contaminant sources.

Air Monitoring - real time air monitoring for organic vapors will be conducted during the field investigation using portable field equipment, and a particulate monitor will be used to assess the presence of other airborne contaminants.

Environmental Assessment - an environmental assessment will be conducted to characterize and

inventory potentially sensitive receptors as well as surface water resources.

Cultural Resources - a Stage 1A cultural resources survey will be conducted in the general vicinity of the site. A Stage 1B cultural resources survey/investigation will be performed if the Stage 1A cultural resources survey indicates important cultural resources in the vicinity of the site.

It is believed that the scope of work defined herein is sufficient to support the risk assessment and FS. However, should the results of the field investigations show that the extent and nature of contamination are not sufficiently defined to support the risk assessment and FS, it will be recommended that a Phase 2 investigation be implemented.

Table 4-1 presents a summary of the proposed RI sampling program including the media to be sampled, the types of data to be collected, the analytical level to be achieved and the analytical parameters.

Section 5.0 of this Work Plan provides the general scope of work for each of the planned field activities. The Field Operations Plan (FOP), including the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPjP), and the Site Health and Safety Plan (HASp) will outline the detailed sampling and analytical procedures for each medium to be sampled, the number and type of each sample and the QA/QC sample requirements for each medium and the site-specific health and safety requirements and measures. The DQO for each sample type will be identified in the FSP based on the highest analytical level for the intended use of the data. The FSP will identify precision, accuracy and completeness goals used in selecting the sampling and analysis methods. The FSP will also contain details of non-laboratory data collection, such as SOPs for well installation, and the collection of soil and water samples. These documents will be prepared after this Work Plan is approved by the USEPA.

SUMMARY OF PROPOSED SAMPLING PROGRAM

MEDIA	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	DATA QUALITY LEVEL	PROPOSED ANALYSES
Soil	Soil Gas Survey	Downgradient from dry cleaner (Parcels A & B) 500,000 AGST Oil Recovery Sump	Locate monitoring wells	I	VOCs
	Subsurface Soil Sampling (borings and test pits)	Parcel B Disposal Area Borings/Test Pits Parcel A Paved Areas Monitoring Well Borings 500,000 AGST Drainage Pipe Borings	Site Characterization Risk Assessment Alternative Evaluation	IV, V	TAL/TCL Total Cyanide, ²³⁰ Th, ²³² Th, ²²⁶ Ra, ²²⁸ Ra, ²³⁸ U
	Borehole Gamma Logging (Phase II)	Based on results of Phase I Gamma Exposure Rate Survey	Same as above	Not Applicable	Gamma Radiation
Ground Water	Monitoring Well Sampling	New and existing monitoring wells Temporary Parcel B well Off-site Monitoring Wells Pumping Test	Same as above	IV, V	TAL/TCL Total Cyanide, TDS, Dissolved Tungsten, ²³⁰ Th, ²³² Th, ²²⁶ Ra, ²²⁸ Ra, ²³⁸ U
Surface Water	Surface Water Sampling	Mud Pond Pond (Parcel B) Intermittent Streams/Drainage Channels Wastewater Retention Tank	Same as above	IV, V	Metals, Inorganics, ²³⁰ Th, ²³² Th, ²²⁶ Ra, ²²⁸ Ra, ²³⁸ U
Sediment	Sediment Sampling	Mud Pond/Mud Holes (2) Intermittent Streams/Drainage Channels Pond (Parcel B) Oil Recovery Sump	Same as above	IV, V	TAL/TCL, TOC, Tungsten, ²³⁰ Th, ²³² Th, ²²⁶ Ra, ²²⁸ Ra, ²³⁸ U
Mixed	Phase I Gamma Exposure Rate Survey	Interior of Buildings Unremediated Areas	Screening for more detailed Phase II measurements	Not Applicable	Gamma Radiation
	Phase I Indoor Radon/Thoron Measurements	Interior of Buildings	Site Characterization Alternative Assessment Risk Assessment	Not Applicable	Radon/Thoron Gas
	Phase II Surface Alpha Measurement	Tanks Interior Surfaces Asphalt	Site Characterization Alternative Assessment Risk Assessment	Not Applicable	Alpha Particle Emitting Radionuclides
	Phase II Building Material Sampling	Same as above	Same as above	V	²³² Th, ²²⁶ Ra
Task Residue	Phase II Tank Residue Sampling	Tanks	Same as above	V	²³⁰ Th, ²³² Th, ²²⁶ Ra, ²²⁸ Ra, ²³⁸ U

5.0 TASK PLANS FOR RI/FS

5.1 TASK 101 - PROJECT PLANNING

The project planning task involves several subtasks that must be conducted to develop the plans and corresponding schedule necessary to execute the RI/FS. These subtasks include conducting a detailed analysis of existing data, reviewing existing project plans, making site visit(s), developing a preliminary risk assessment, identifying preliminary remedial alternatives, determining preliminary DQOs, determining preliminary ARARs and holding a Work Plan review meeting with USEPA and other interested agencies. All of these activities culminate in the preparation of the final project plans. The detailed analysis of existing data, identification of preliminary ARARs, the development of the preliminary risk assessment, remedial action objectives/alternatives, as well as identification of DQOs, are contained in Sections 3.0 and 4.0 of this Work Plan.

The project plans include the preparation of this Work Plan and a Field Operations Plan (FOP). The FOP consists of two subsections: the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPjP). The FOP will be prepared after the Work Plan is approved by the USEPA. A Health and Safety Plan (HASP) will also be prepared and submitted with the FOP. The HASP will include elements described in Appendix B of the RI/FS guidance document (USEPA, 1988a), and will comply with OSHA and 29 CFR 1910.120.

The QAPjP will describe the policy, organization, functional activities, and quality assurance and quality control protocols necessary to achieve DQOs dictated by the intended use of the data. The FSP provides guidance for all fieldwork by defining, in detail, the sampling and data-gathering methods to be used on the project. Field methods, sampling procedures, and custody shall be based on established protocols (USEPA, 1987c). The QAPjP and FSP will contain the elements listed in Table 2-4 and described in Appendix B of the RI/FS guidance document (USEPA, 1988a).

The FOP will provide detailed procedures for each field activity including:

- Standard operating procedures (SOPs) for Field Investigations including sampling, monitoring, and field instrument calibration
- Number, location and types of samples
- Analyses to be performed on each sample
- Chain-of-custody procedures
- Special Analytical Services (SAS) procedures
- Sample packaging and shipment procedures
- Decontamination procedures
- QA/QC of field sampling and procedures for field changes and corrective action
- Responsibilities of site personnel
- Parameters to be analyzed and analytical methods

Each SOP or QA/QC protocol will be prepared in accordance with USEPA Region II guidelines and the site-specific Health and Safety Plan (HASP).

The QA/QC portions of the FOP will be prepared in accordance with USEPA Region II Standard Operating Procedures (SOPs) and Section 10 of the USEPA publication entitled Test Methods for Evaluating Solid Waste (SW-846) Revision 3 (USEPA, 1986c) and the latest update (March, 1992) of the Region II QA/QC Manual (USEPA, 1989f). Information will be included regarding sample quality objectives, detection limits, preservation techniques, laboratory testing protocols, and laboratory accuracy and precision goals.

The FOP will present information on data validation. All chemical data generated by CLP laboratories will be validated by USEPA Region II trained and certified personnel using USEPA's Contract Laboratory Program Standard Operating Procedures HW-2 and HW-4 (USEPA, 1990a; 1990b).

In addition, the FOP also presents the following:

- Site control procedures,
- Field investigation activities and responsibilities (site operations)
- The corresponding field operations schedule

The site control section describes how approval to enter the areas of investigation will be obtained, along with the site security control measures and the field office/command post for the field investigation. The logistics of all field investigation activities are also described. The site operations section includes a project organization chart and delineates the responsibilities of key field and office team members. The last section includes a field operations schedule, showing the proposed scheduling of each major field activity.

5.2 TASK 102 - COMMUNITY RELATIONS

The USEPA will develop a community relations program and provide the community relations support for the site with supplemental support from the Contractor as requested. The USEPA will coordinate the community relations program.

5.3 TASK 103 - FIELD INVESTIGATIONS

5.3.1 Overall Objective

The purpose of the field investigations is to obtain valid data to evaluate the potential sources of contamination by defining the nature, depth and extent of contamination resulting from operations at the site. In addition, the field investigations will assess migration pathways from the sources and evaluate the potential contribution from the adjacent Mattiace and former dry cleaning sites.

The data generated during the field investigation will be used to assess what risks, if any, the contamination resulting from operations at the Li Tungsten site presents to public health and to the environment. Based on these data, it will be determined whether the contaminants are of sufficient concentration to warrant a remedial action. Finally, the data will be used to evaluate appropriate remedial response alternatives for the site.

5.3.2 Subcontracting

To support the proposed field activities, the following subcontracts will be required:

- A drilling subcontract for soil borings, monitoring well installation, well development and testing, and excavation of test pits.
- A waste hauling subcontract to remove drill cuttings/residuals and purged groundwater from the site.
- A surveying subcontract for surveying of monitoring well and staff gauge locations and elevations and surface water, sediment, and soil sample locations.
- A geophysical subcontract to search for buried drums.
- Subcontracts for other services such as topographic survey, field office trailer, Non-CLP laboratory, as required.
- A radiation survey subcontract.

Selection of subcontracts will be achieved by applicable Federal Acquisition Regulations (FAR), for services such as drilling, waste hauling, geophysics, radiation monitoring, and surveying.

Other subcontracts will be awarded in accordance with Part 15 of the FAR entitled "Contracting by Negotiations". All subcontracts in excess of \$10,000 will be solicited by a competitive bid process and those in excess of \$25,000 will be submitted to the USEPA CO for consent.

Full and open competition will be obtained on all procurements in excess of \$1,000. A diligent effort will be made to procure the services of qualified Small Business Enterprises (SBEs) or Small Disadvantaged Business Enterprises (SDBEs).

5.3.3 Mobilization and Demobilization

This subtask will include field personnel orientation, equipment mobilization, the staking of well and sampling locations, and demobilization. Each field team member will attend an on-site orientation meeting to become familiar with the history of the site, health and safety requirements, and field procedures.

Equipment mobilization will involve the ordering, purchasing, and if necessary, fabrication of equipment needed for the field investigation. A complete inventory of equipment required for the site investigations will be prepared prior to initiating field activities. A field office trailer will be set up and necessary utility hookups will be made as part of the mobilization effort.

Locations of the surface soil samples, soil borings, test pits, and groundwater monitoring wells will be field checked and staked at the start of the site operations. The locations will be measured from existing landmarks. A utilities check and stakeout will be conducted at the location of each subsurface investigation.

Equipment mobilization may include (but will not be limited to) sampling equipment, drilling subcontractor equipment, health and safety decontamination equipment, and field office trailer and utility hookups. Equipment will be decontaminated and demobilized at the completion of each phase of field activities as necessary.

Decontamination solutions, drill cuttings, well development water and purge water will be stored on-site in DOT-approved 55-gallon drums or in an on-site tank. The drums will be permanently numbered and an inventory of their contents maintained.

The disposal of drummed drill cuttings, well development water, decontamination water, purge water, and health and safety equipment at the time of demobilization, will be the responsibility of the Contractor. Off-site disposal of wastes generated during the RI/FS field activities that are determined to be hazardous and/or contain lower levels of radioactivity, will be carried out by the Contractor under the contractual provisions of indemnification.

5.3.4 Physical Characteristics Survey

5.3.4.1 Surface Features Investigation

The surface features investigation will include a site reconnaissance and field verification of previously identified features. Surface features that are potential sources and migration routes of contaminants, such as surface water drainage channels, the above ground storage tank, the Mud Pond, the two Mud Holes, and disposal areas will be identified.

A topographic base map will be prepared which will show the location and elevation of the surface features. The existing monitoring wells will be included to verify previous survey data. This will ensure reliable groundwater elevation measurements and subsequent interpretation of groundwater movement. A permanently marked reference point on the inner casing of each well will be surveyed for vertical and horizontal control referenced to the MSL datum. Additional monitoring wells installed during the field investigation and new sampling locations will be surveyed and incorporated on an updated map.

5.3.4.2 Subsurface Features Investigation

Geophysical Survey

A geophysical survey using a magnetometer will be conducted by a subcontractor to provide information on potential buried drums, tanks, or other subsurface features in selected parts of the site. The magnetometer survey will be useful in locating reported underground storage tanks in the absence of surface features (i.e., vent pipes or fill pipes).

The majority of Parcel A is either covered with concrete slabs or contain various aboveground or belowground structures (e.g., buildings, tanks, drums). The structural steel contained in these structures may interfere with performance of a magnetometer survey. Electromagnetic (EM) surveys, are less affected by the presence of metal and will be used in those areas where a magnetometer survey is unsuitable. Parcel B is mostly overgrown with vegetation, is unpaved, and has limited surface features that would interfere with a magnetometer survey. A magnetometer survey of Parcel B should indicate the presence of drums that might be buried in the disposal area and the remainder of the parcel. Portions of Parcel C are also developed, however, the number and spacing of the surface structures

should not interfere with a magnetometer survey over most of the parcel. As in Parcel A, any subsurface areas of Parcel C which cannot be clearly mapped by a magnetometer survey will be investigated using EM techniques. Virtually all of Parcel C' should be suitable for a magnetometer survey.

The magnetometer and/or EM surveys will be conducted by establishing grids in each of the selected areas so that accurate and systematic measurements can be made and to define the locations of any anomalies that are detected. The grids will be based on two baselines established across the areas of concern. Lines of markers (pin flags or stakes) will be placed in an approximate north to south direction from each of the flagging locations on the baseline. Markers will be placed at 10-foot intervals along the north to south grid lines.

A base station for the magnetometer will be established at a convenient location that will not be influenced by nearby magnetic anomalies. The field team will make measurements at the base station three times a day. A drift correction will be applied to the data. The corrected magnetometer and EM data will be presented in graphic form as profile plots and contour maps.

Geological Survey

Twenty-three monitoring wells were installed on the site during previous investigations. Most of the wells were installed by Geraghty & Miller, Inc. (G&M) in 1988. The hydrogeologic investigation focused primarily on characterizing shallow groundwater chemistry in the upper glacial aquifer (G&M, 1988). Only three wells were drilled to a depth greater than 20 feet and only one well to more than 25 feet. Therefore, except for the USGS log of supply well N1917, little information is available about the deeper site geology.

As discussed in Section 3.1.4, a clay confining unit occurs at a shallow depth on the site however, the configuration and depth of the formation is unknown. A contour map of what is believed to be the same clay surface was prepared for the Mattiace site (EBASCO, 1991). That map shows large changes in the elevation of the clay surface over short distances. Similar relief on the clay surface may exist on the Li Tungsten site.

To delineate the configuration of the clay surface on the site, additional deep borings will be drilled for the installation of additional monitoring wells. These borings will provide information needed to further define depth of vertical contaminant movement, the extent to which the clay acts as a confining unit, and an enhanced understanding of the groundwater flow regime. Installation of additional monitoring wells is discussed in Section 5.3.4.4. Geologic cross-sections will be prepared which incorporate data from the deep well borings and existing boring logs.

5.3.4.3 Soils and Vadose Zone Investigation

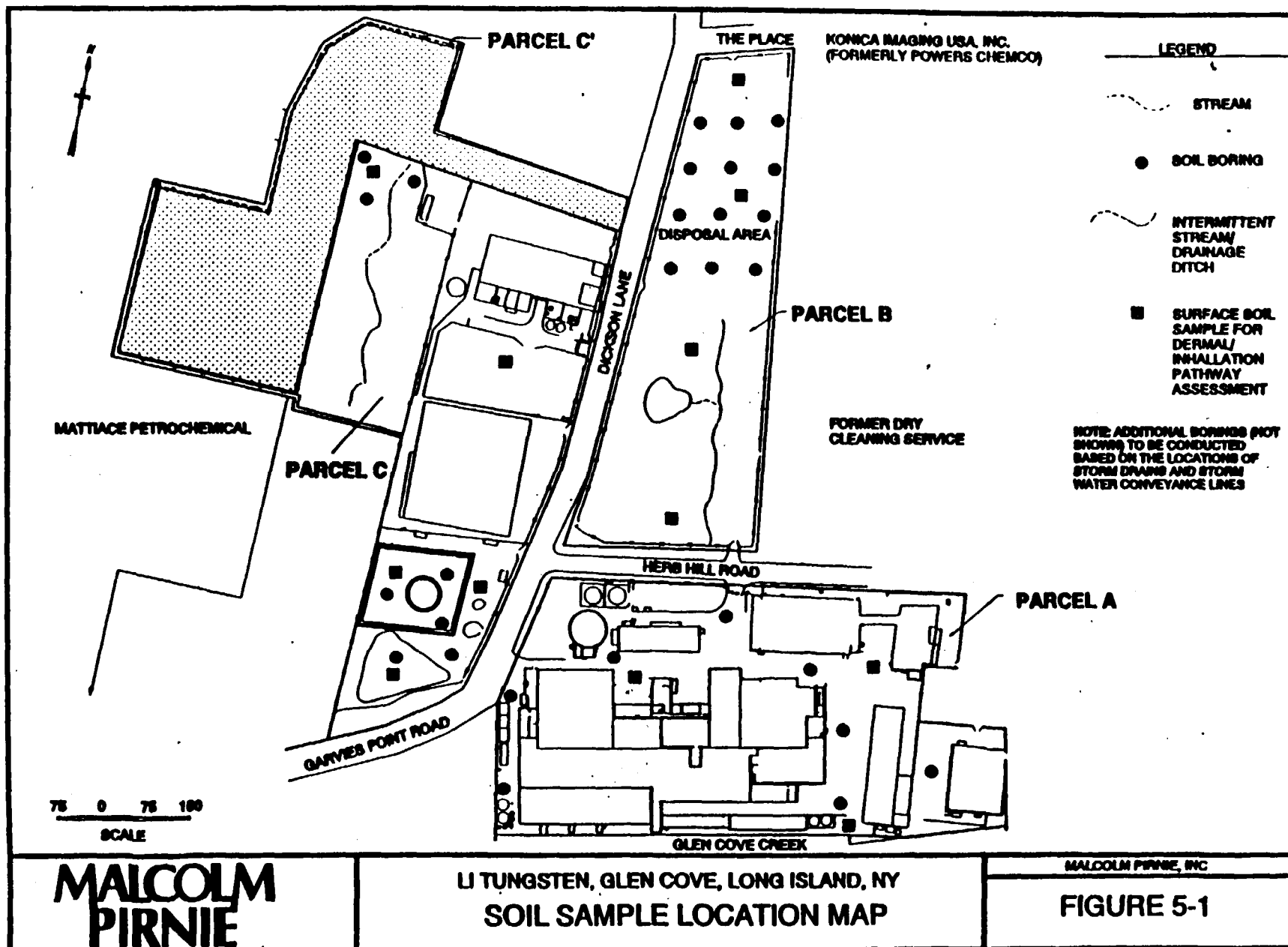
The soils and vadose zone investigation will consist of a soil boring program and a test pit program. Details of each are provided below.

Soil Boring Program

A soil boring program consisting of 28 boreholes is proposed. The three objectives of the soil boring program include the following: provide detailed information on the vertical limits of the buried waste (e.g., in the disposal area on Parcel B); assess the presence, nature and extent of contamination in the vadose zone; and further characterize site stratigraphy.

Twelve borings are proposed in the Parcel B disposal area as shown on Figure 5-1. A temporary casing will be installed into one of the boreholes for the purpose of collecting a groundwater sample from a hydraulically downgradient direction. The groundwater sample will be analyzed utilizing a quick turnaround. The results of this analysis will be used to determine if the borehole will be grouted or converted into a permanent monitoring well.

Three borings are also proposed in the northwest corner of Parcel C in the area of scarred vegetation. Five borings are proposed in the southern portion of Parcel C around the 500,000 gallon storage tank. Eight borings are proposed on Parcel A beneath the paved areas. Details of chemical analyses to be conducted on soil samples collected in each boring are described in Section 5.3.5.4. Proposed boring locations are shown on Figure 5-1.



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Twelve surface soil samples are proposed to assess the potential for dermal/inhalation pathways associated with surface soil contaminants. The proposed surface soil sample locations are also shown on Figure 5-1.

Soil borings will also be drilled adjacent to the existing storm sewer system to determine the extent to which it functions as migration pathway and contaminant source to the groundwater and Glen Cove Creek. Borings will be drilled to the invert elevations of the drainage pipes. Soil samples will be collected one-foot below the invert elevation for physical and chemical analyses. The number of borings to be drilled will depend on the location and number of drainage pipes that can be verified. Based on existing data, however, it is estimated that approximately 15 soil borings will be drilled. The location of known drainage pipes and outfalls to Glen Cove Creek, and the proposed location of the 15 soil borings are shown on Figures 5-1A and 5-1B.

Standard penetration tests (SPT) consistent with ASTM D-1586 will be an integral part of the soil boring program. SPT will be used to estimate the in-situ consistency of the soils encountered. Additional engineering properties will be determined on the soil samples collected in selected borings. Split-spoon samples will be visually described and classified by a geologist according to the modified Burmister System. Each sample will be screened with a photoionization detector in the field to check for volatile organic compounds and a Geiger Mueller (GM) pancake detector for radionuclides.

Soil samples collected in selected borings will undergo testing for index and engineering properties. Representative samples of each of the strata penetrated by the boring will be selected for testing. Testing will augment the visual classification of the soil and characterize the material according to the following properties:

- Atterburg limits
- Particle size distribution
- Moisture content
- Bulk density

Soil borings used for the installation of monitoring wells will be drilled in the same manner described above. Split-spoon soil samples will be collected continuously in each boring. When cluster wells are being installed, soil samples will be collected only in the deeper

75 50 25 0 FEET 75

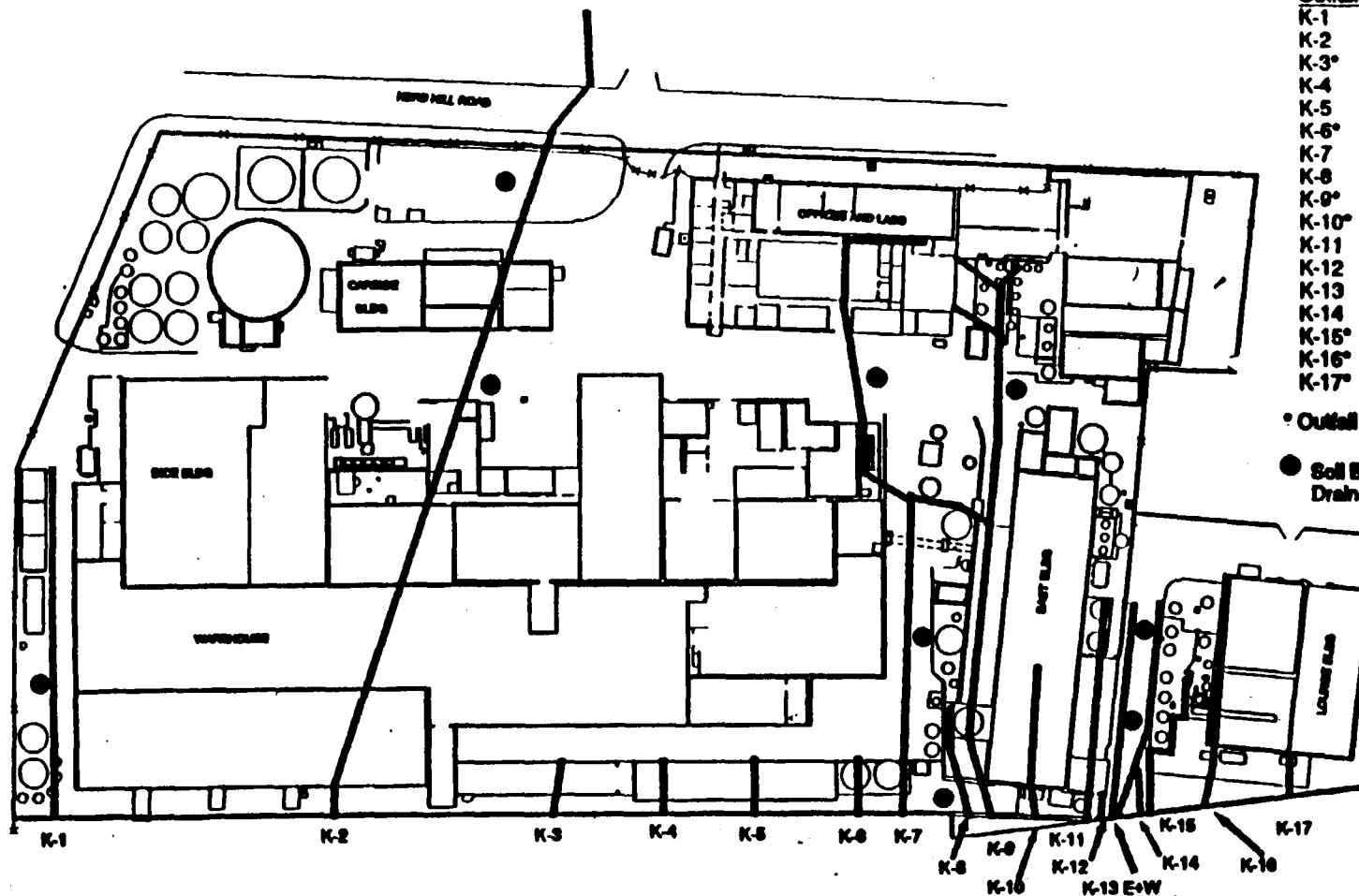
SCALE IN FEET

LEGEND

Outfall No.	Dia. of Pipe
K-1	12
K-2	12
K-3*	6
K-4	6
K-5	12
K-6*	12
K-7	12
K-8	6
K-9*	6
K-10*	18
K-11	8
K-12	7
K-13	15
K-14	12
K-15*	4
K-16*	6
K-17*	6

* Outfall Location Field Verified

● Soil Boring Location Near Drainage Lines



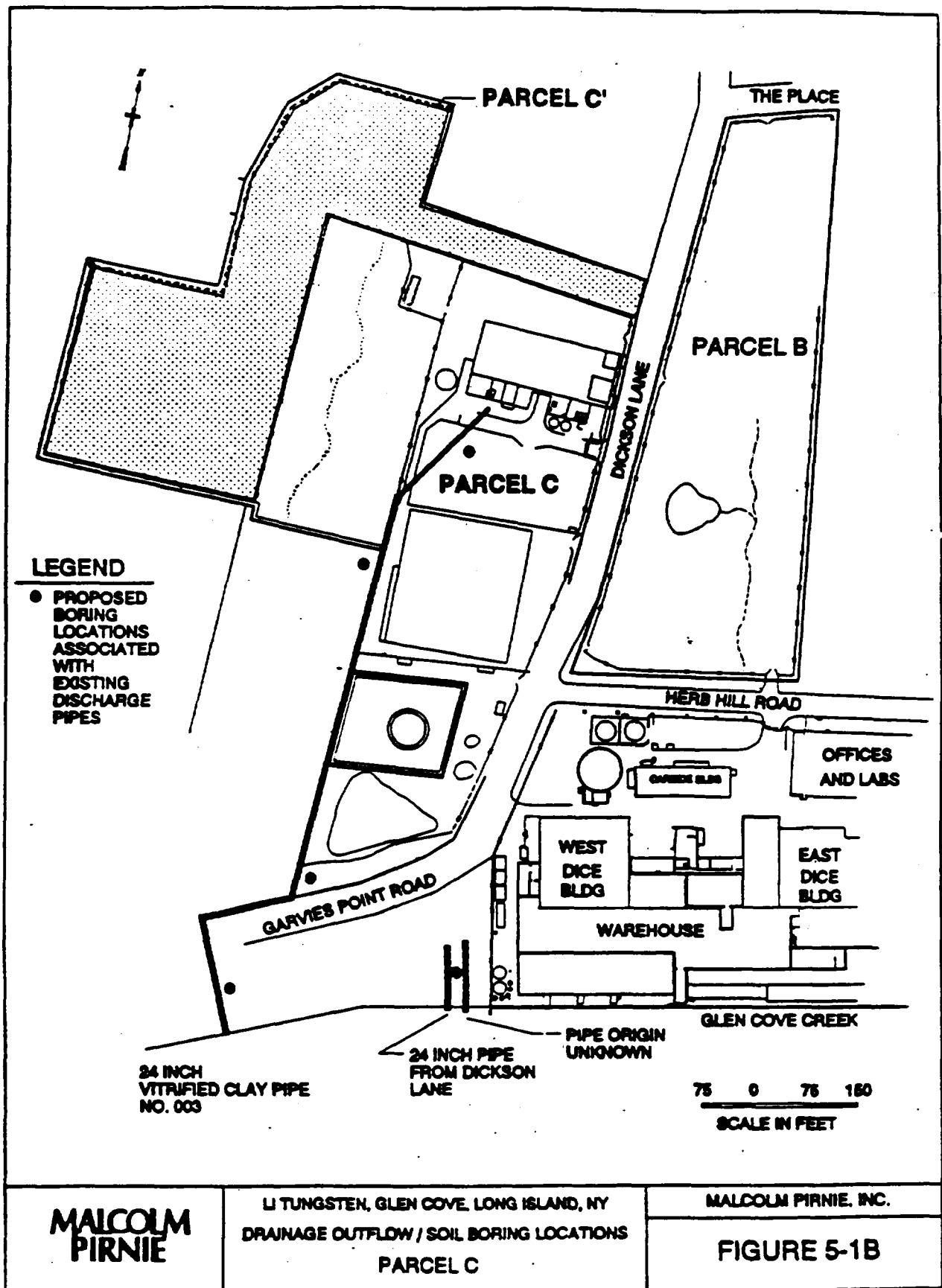
**MALCOLM
PIRNIE**

LI TUNGSTEN, GLEN COVE, LONG ISLAND, NY
DRAINAGE OUTFALL / SOIL BORING LOCATIONS
PARCEL A

MALCOLM PIRNIE, INC

FIGURE 5-1A

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boring of the cluster. The soil samples will be screened with a photoionization detector to detect possible volatile organic compounds and a GM pancake detector to check for radioactivity. Selected samples will be tested for properties described above. If clay bedsthicker than two feet are encountered, the next deeper soil sample will be collected in a Shelby tube that will be sent for laboratory analysis of vertical hydraulic conductivity.

Test Pit Program

Six test pits will be excavated around the disposal area to assess the subsurface extent and to collect samples of soil and buried waste. The tentative location of six test pits are shown on Figure 5-2, however, the final locations will be determined based on results of the soil boring program. Final test pit locations and the number of pits will be dependent upon the results of the soil boring program. In general, the test pits will be located around the perimeter of the disposal area.

5.3.4.4 Hydrogeology

The hydrogeologic investigation is proposed to further delineate the vertical and lateral extent of contamination, to refine the understanding of the groundwater flow system, and to estimate aquifer parameters. An understanding of these site characteristics is needed to determine the scope of potential remedial actions.

Existing Monitoring Well Evaluation

There are 23 existing monitoring wells on the site which are screened in the shallow groundwater. Data on well construction, construction date, screen length, construction material, well diameter, total depth, and top of casing (TOC) elevation are presented on Table 5-1. Well logs for "EMW" series monitoring wells are not available; boring logs and well construction details for the "GM" series monitoring wells are included in Appendix E.

Water supply well N1917 intersects the Lloyd aquifer. If this well still exists and is found to be in good condition, water levels can be measured and water samples collected in the Lloyd aquifer to supplement the data from the shallow monitoring wells. The location of the existing wells is shown in Figure 5-3.

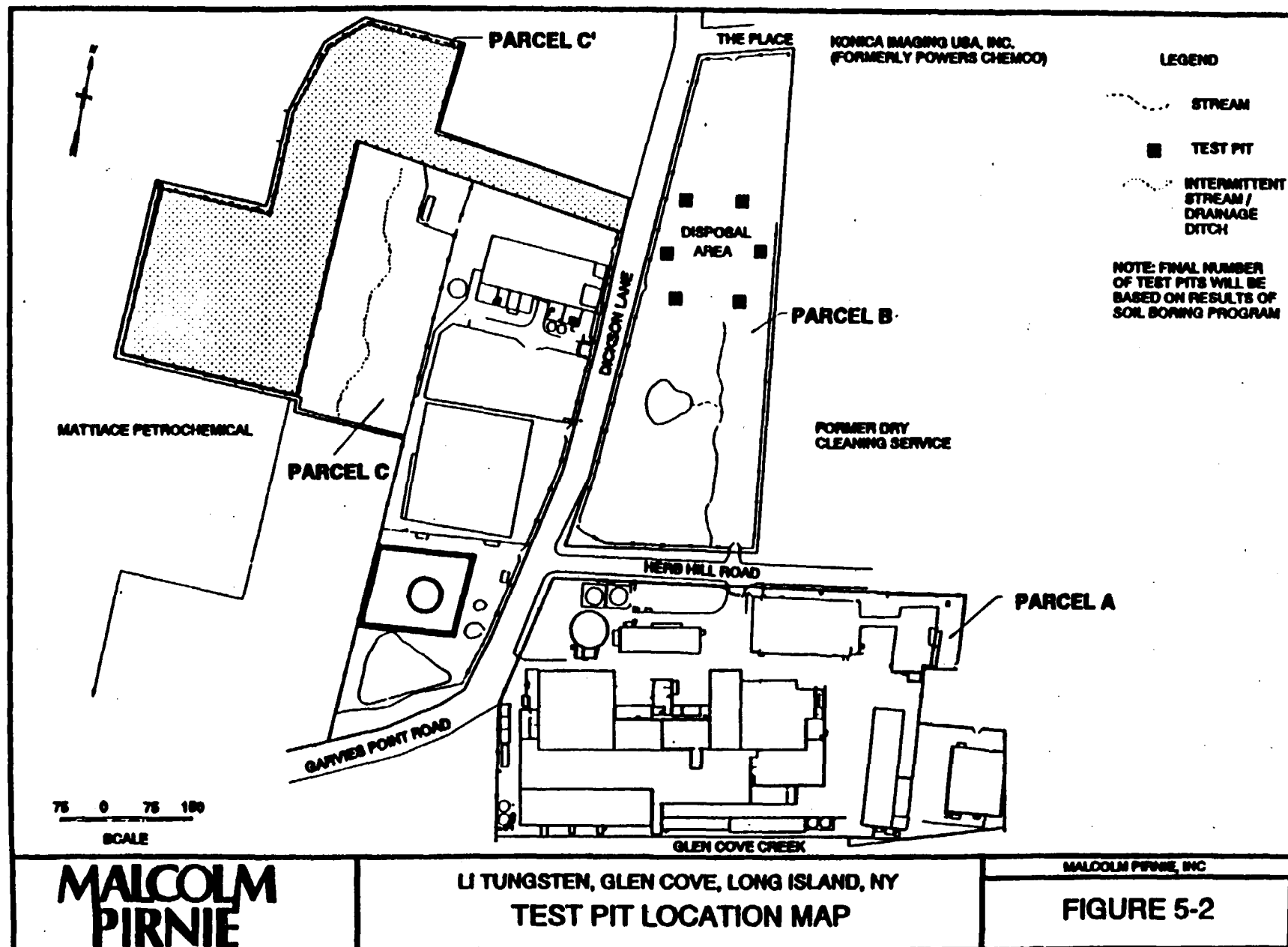
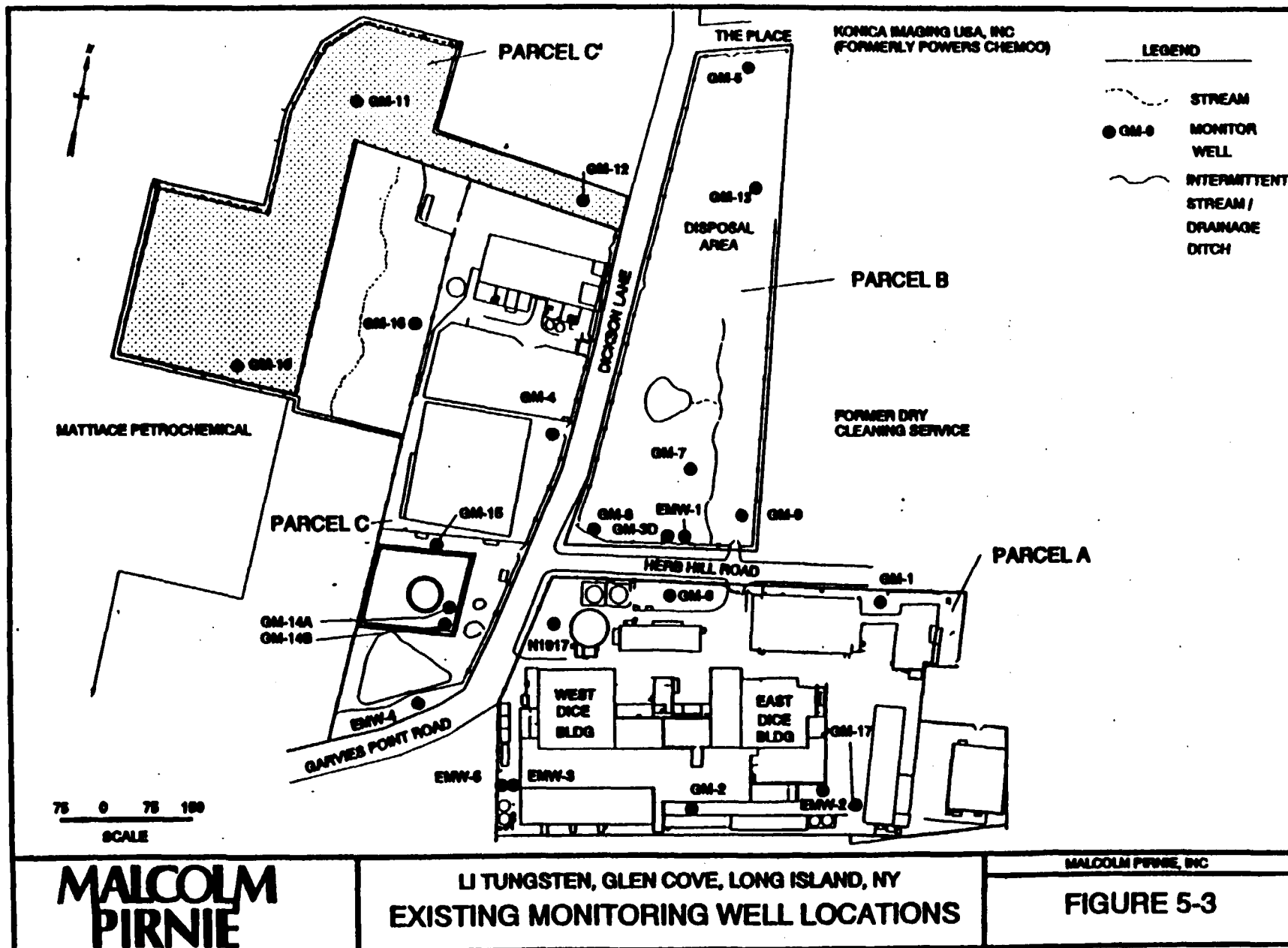


TABLE 5-1
SUMMARY OF EXISTING MONITORING WELL DATA
LI TUNGSTEN SITE, GLEN COVE, NEW YORK

Well Number	Well Completion Date	Total Depth	Screen Interval	Screen Slot Size	ID of Well	Height of Measuring Pt. Relative to Ground Surface	Elevation of Measuring Point	Soil Description
EMW-1	NA	14.1	4.1 - 14.1	NA	4	NA	16.75	NA
EMW-2	NA	5.5	0.0 - 5.5	NA	4	NA	6.96	NA
EMW-3	NA	9.9	+0.1 - 9.9	NA	4	NA	9.64	NA
EMW-4	NA	18.6	8.6 - 18.6	NA	4	NA	12.56	NA
EMW-5	NA	9.0	0.0 - 9.0	NA	4	NA	9.62	NA
OM-1	4/09/87	14.8	4.8 - 14.8	0.010	2	+0.60	18.02	0' - 2' Fill/Brown Silty SAND 2' - 16' Brown SAND
OM-2	4/14/87	12.4	2.4 - 12.4	0.010	2	-0.15	6.64	0' - 3' Gray/Black (SAND) 3' - 6' Clay/Brown (SAND) 6' - 16' Brown/Orange SAND
OM-3D	4/14/87	23.5	13.5 - 23.5	0.010	1.5	+0.40	16.02	0' - 9' Brown SAND 9' - 16' Tan Silty SAND 16' - 26' Tan SAND
OM-4	4/15/87	15.4	5.4 - 15.4	0.010	1.5	-0.30	26.06	0' - 9' (SAND) 9' - 14' Silty SAND 14' - 16' Clayey Silty SAND
OM-5	4/21/87	22.0	12.0 - 22.0	0.010	1.5	+0.90	41.94	0' - 9' Silty SAND 9' - 24' SAND
OM-6	3/31/88	12.2	2.2 - 12.2	0.010	2	-0.40	13.29	0' - 2' Fill/Brown SAND 2' - 12' Tan fm SAND
OM-7	4/1/88	12.9	2.9 - 12.9	0.010	2	+3.10	21.55	0' - 8' Silty SAND 8' - 12' Clayey SILT 12' - 14' mc SAND
OM-8	4/4/88	12.9	2.9 - 12.9	0.010	2	+2.50	18.49	0' - 12' Orange/Brown SAND
OM-9	4/4/88	12.1	2.1 - 12.1	0.010	2	+2.40	20.60	0' - 10' Silty SAND 10' - 12' SAND
OM-10	4/6/88	54.1	44.1 - 54.1	0.010	2	+3.30	59.46	0' - 10' SAND 10' - 12' Silty CLAY 12' - 52' SAND
OM-11	4/7/88	14.2	4.2 - 14.2	0.010	2	+2.07	47.47	0' - 12' SAND
OM-12	4/11/88	14.0	4.0 - 14.0	0.010	2	+2.55	49.83	0' - 2' mc SAND 2' - 10' Silty CLAY 10' - 17' CLAY
OM-13	4/11/88	16.8	6.8 - 16.8	0.010	2	+2.30	44.09	0' - 5' fm SAND 5' - 7' Silty CLAY 7' - 15' SAND 15' - 17' CLAY
OM-14A	4/12/88	17.8	7.8 - 17.8	0.010	2	+2.50	17.25	0' - 10' Silty SAND 10' - 17' Silty CLAY
OM-14B	4/14/88	11.3	1.3 - 11.3	0.010	2	+1.15	16.16	
OM-15	4/13/88	14.3	4.3 - 14.3	0.010	2	-0.20	17.50	0' - 7' Silty SAND 7' - 16' SAND
OM-16	4/16/88	9.0	+0.6 - 9.0	0.010	2	+0.60	36.44	0' - 7' fm SAND
OM-17	4/18/88	10.5	0.5 - 10.5	0.010	2	-0.30	----	0' - 6' mc SAND 6' - 10' Sand & Gravel

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The existing monitoring wells will be inspected to evaluate their condition for collecting groundwater level and chemical data. The reported construction of each well will be compared to the specifications presented in Table 5-1. Each well will be sounded to confirm the depth of the well and to detect possible accumulation of sediment in the bottom of the well screen. The cement collar around each well will be checked for cracks and settling. If the cement collar is flawed, surface water may be able to enter the well and compromise the value of groundwater samples. If it is determined during inspection that a well requires rehabilitation, repairs will be conducted prior to measurements of water levels and collection of water samples. If a well cannot be rehabilitated, a decision will be made in consultation with the USEPA on the need to replace the well.

Water Level Measurements

Synoptic groundwater levels will be measured in the existing wells and contour maps will be prepared to confirm the current understanding of groundwater movement. Water levels will be measured once prior to the installation of the proposed new wells to confirm the locations. Water levels in the existing wells will also be measured after the new wells have been installed, developed and permitted to equilibrate.

Synoptic water levels will be measured in all on-site monitoring wells selected off-site wells and the surface water bodies (Mud Pond, the Mud Holes and the pond on Parcel B) twice each month during field activities. This frequency will permit collection of sufficient data to determine seasonal average flow direction. Water levels will be measured with an electronic water level meter to an accuracy of 0.01 feet.

Installation of Additional Monitoring Wells

Additional monitoring wells will be installed for collecting groundwater samples for chemical analysis, for measuring groundwater elevations to estimate the direction of groundwater movement, for conducting aquifer testing to estimate hydraulic characteristics of the upper glacial aquifer and to delineate the top of the clay confining unit. Ten new monitoring wells (three shallow, seven deep) will be installed at the locations shown on Figure 5-4. Additional shallow monitoring wells may be installed depending on the results of the soil gas survey (Section 5.3.5.1). The rationale for the well placement is given in Table 5-2.

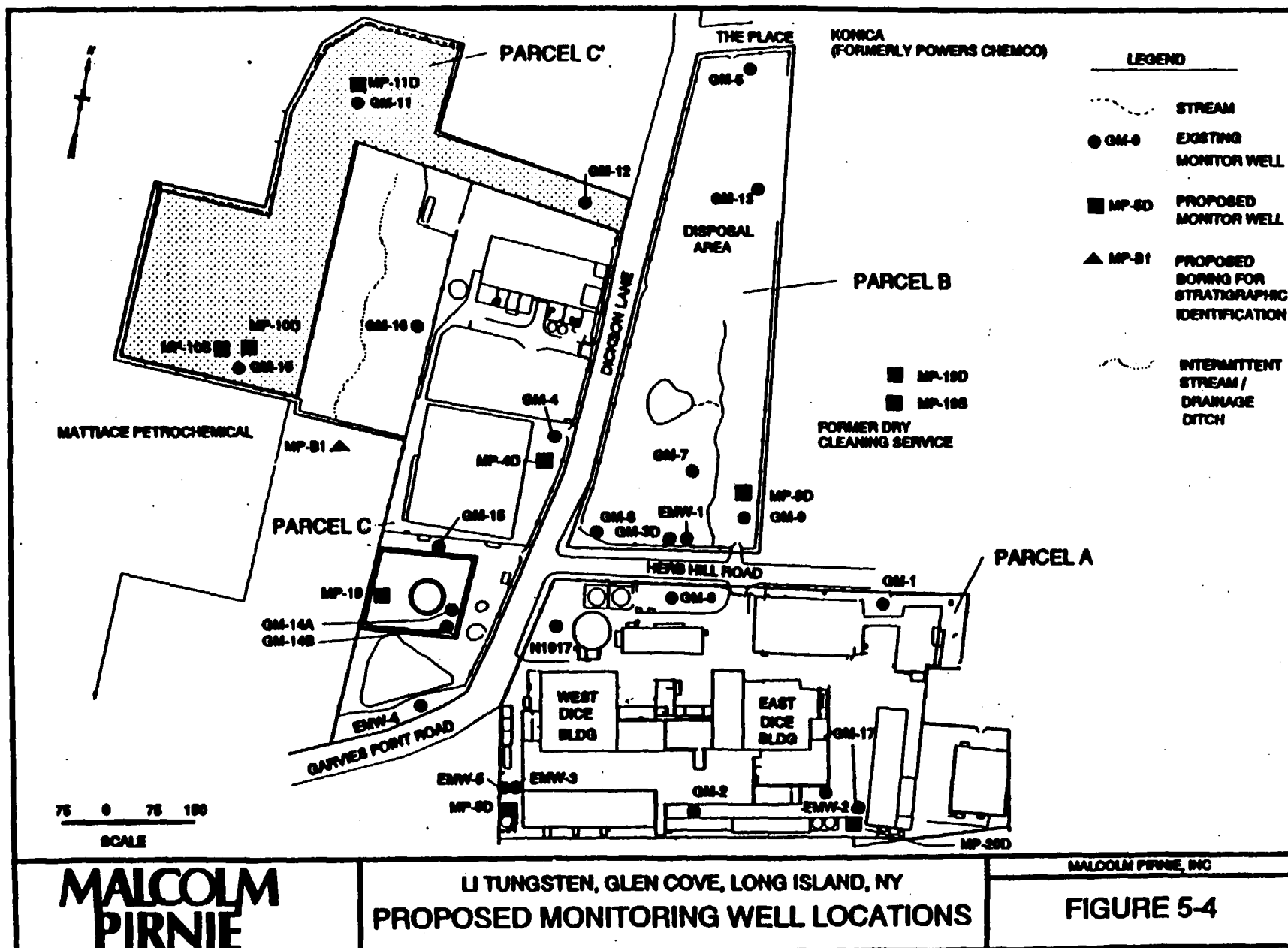
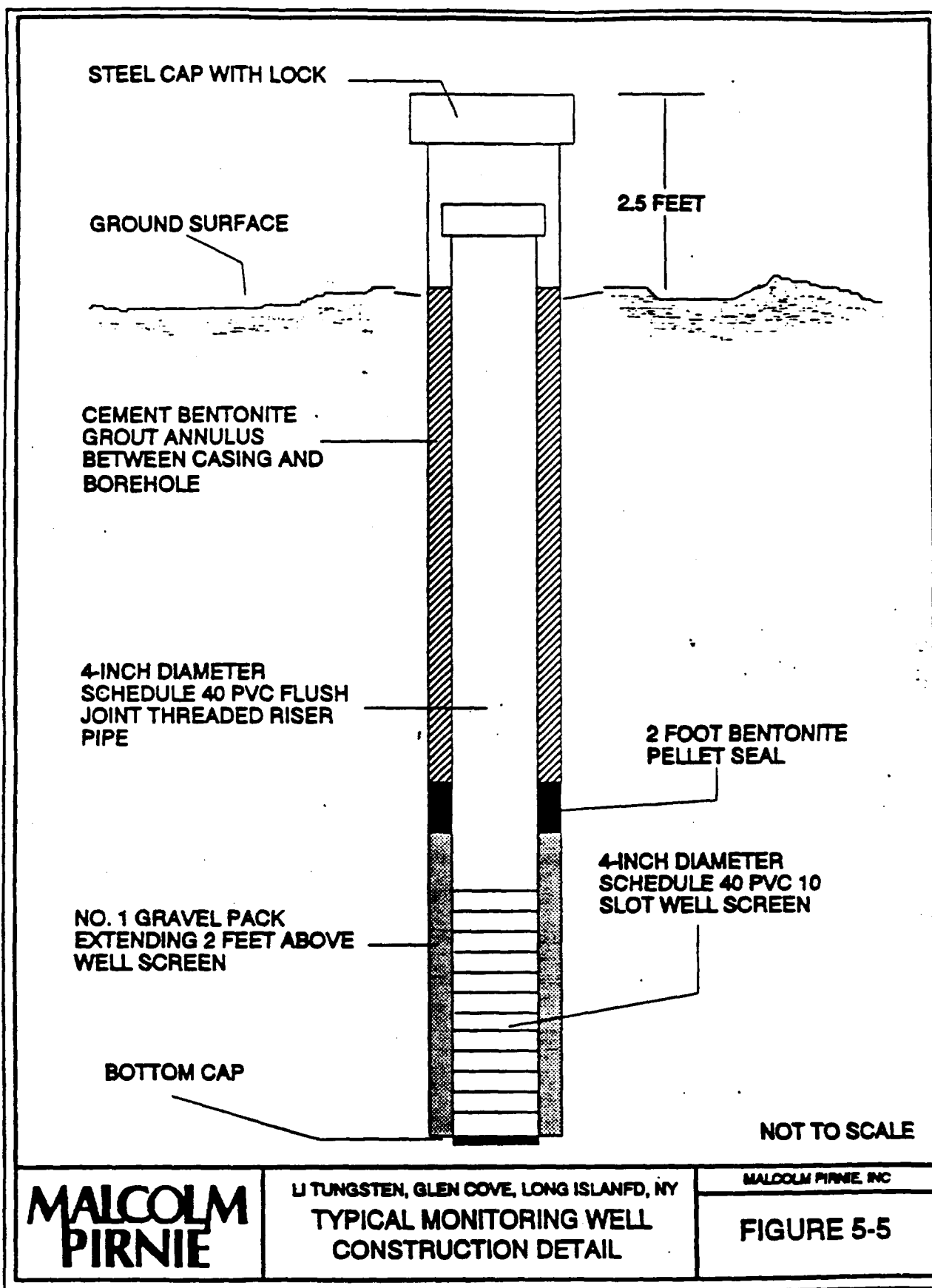


TABLE 5-2	
RATIONALE FOR NEW MONITORING WELLS	
Proposed Well	Rationale
MP-4D, MP-5D, MP-9D, MP-10D, MP-11D	Only 3 of the 23 wells previously installed on-site were drilled to the top of the clay confining unit. These were GM-12, GM-13, and GM-5, which are located in the northern portion of the site. The remaining wells did not encounter the clay unit. To further define the depths and extent of the clay unit, a series of wells is proposed to be drilled to the top of the clay confining unit. This will establish the contour of the top of the clay and will be compared with the local ground water flow on the Li Tungsten site. Additionally, the top of the clay surface needs to be established to evaluate the potential vertical extent of contamination at the site. The locations of the deep wells will provide for preparation of north to south and east to west cross-sections showing the clay surface elevation.
MP-10S MP-10D	<p>Water quality samples collected in GM-10 detected the presence of elevated concentrations of 1,1,1-trichloroethene and other VOCs. The soil gas survey did not reveal any VOCs in the surface soil in the vicinity of GM-10. Well number MW-6S on the Mattiace property is located 150 feet from the Li Tungsten monitoring well GM-10. Ground water quality data from the Mattiace well MW-6S showed very high levels of 1,1,1-trichloroethene, as well as numerous other VOCs. The source of the VOC contamination in GM-10 is unknown. However, it is possible that the contaminant source is off-site.</p> <p>To delineate the concentration gradient of contaminants in the vicinity of GM-10, two additional cluster wells are proposed. Well GM-10 has a screen interval of 44 to 54 feet below ground surface. The two new wells will be screened above and below the screen interval of GM-10. The shallow well, GM-10S, will bridge the water table. The deep well, GM-10D, will be drilled to the confining clay unit and screened 10 feet above the clay unit. The cluster of wells will determine whether the contamination observed at GM-10 is from off-site sources.</p>
MP-18	Petroleum hydrocarbon contamination has been identified in the vicinity of the 500,000 gallon storage tank located on the Li Tungsten site. Petroleum hydrocarbon contamination was identified in soil samples collected during the drilling of GM-14A. No petroleum hydrocarbon contamination was observed on the ground water quality analyses. Monitoring well MP-18 is being proposed as an upgradient well to existing wells GM-14A and GM-14B. Soil and ground water samples taken from MP-18 will determine the presence and extent of petroleum hydrocarbon contamination around the fuel tank in conjunction with the existing wells. Furthermore, because the local ground water flow direction in the vicinity of the proposed well MP-18 is from the Mattiace property, MP-18 will provide information as to possible contaminants emanating from the Mattiace site onto the Li Tungsten site.
MP-19	Previous studies have identified a VOC plume emanating from a former off-site dry cleaning service located west of the Li Tungsten site. The primary contaminant identified was tetrachloroethene and its breakdown products. Similar contaminants have been identified in wells located at the Powers Chemco site directly north of the Li Tungsten site. Monitoring well MP-19 will be located off-site and upgradient of the former dry cleaning service to determine whether VOC contamination is present. This will help establish the source of VOC contamination flowing onto the Li Tungsten site.

The shallow monitoring wells will be installed to bridge the water table with four feet of the well screen set above the water table and six feet below to allow for seasonal and tidal fluctuations in water level. Wells which bridge the water table will provide the best means to detect the presence (if any) of light non-aqueous phase liquids (LNAPLs) floating on the surface of the water table. The deep monitoring wells will be installed with 10 feet of screen set just above the top of the clay unit. Once the clay unit is reached, the boring will be drilled a minimum of five feet into the clay to confirm that the areally extensive clay confining unit has been reached. The borehole in the clay will be backfilled with cement bentonite grout to the top of the clay unit prior to installing the monitoring well.

The well borings will be drilled with a hollow stem auger rig. Split-spoon samples will be collected continuously for the full depth of each boring. Soil samples will be screened with HNu and/or OVA meters to detect possible organic contamination and a GM pancake detector to detect possible radioactivity. Samples will be archived and stored on-site in labeled, clean, glass jars for the duration of the project.

Monitoring well design and installation will conform with USEPA and NYSDEC requirements. The monitoring wells will be constructed with four-inch diameter PVC casing and PVC well screen. Screen slot size and appropriate filter-pack grade will be determined in the field by a hydrogeologist based upon visual inspection of the formation grain size of the interval to be screened. Typical well construction details are shown on Figure 5-5. A 10-foot length of screen will be used in each well with a filter pack extending not more than one foot below and two feet above the screen. A two foot thick bentonite pellet seal will be placed above the filter pack and cement/bentonite slurry will be tremie-grouted in place above the bentonite seal up to the frost line. The remaining annular space will be sealed with expanding cement and a locking eight-inch steel protective casing will be placed over the riser pipe and seated the cement. A sloped concrete well apron will be constructed around each well. The riser pipe will be capped with a threaded, flanged or compression seal well cap and a one-quarter inch diameter vent hole will be drilled into the casing just below the cap. A permanent surveyor's mark will be placed on the concrete well apron and on the top of the riser for use as measuring points.



Drilling Equipment Decontamination Procedures

To prevent the possibility of cross contamination between boreholes, the work area on the drilling rig and the drilling tools will be thoroughly decontaminated before mobilization and between drilling locations. A pressurized steam cleaner will be used on-site to decontaminate the drilling rig and tools. Steam cleaning will occur on an on-site decontamination pad. Water collected in the decontamination pad sump will be pumped to DOT approved 55-gallon drums or to an on-site tanker. Split-spoon samplers will be decontaminated between each use.

Well Development

Well development improves the hydraulic connection between the well and the saturated zone and removes drill cuttings and fine particles from the well. Wells will be developed with a pump to remove clay and other fine particles. During well development, turbidity, pH, specific conductivity and groundwater temperature will be monitored using field equipment. Wells will be developed for a minimum of one hour or until the water reaches a turbidity of 50 NTU's and the pH, temperature and conductivity have stabilized to within 10 percent variation between measurements.

Decontamination solutions, drill cuttings, and well development purge water resulting from the installation and development of monitoring wells will be stored on-site in DOT-approved 55-gallon drums or in an on-site tanker. Drums containing cuttings or water will be permanently numbered and an inventory of their contents maintained. The method of disposal will be determined after soil and groundwater analytical results have been obtained. Details on decontamination and storage of materials will be discussed in the FSP.

Well Surveying

New wells will be marked with a permanent reference point on the riser and on the well apron. These points will be surveyed for vertical and horizontal control using MSL datum. Vertical elevations will be surveyed to within 0.01 feet MSL. Vertical elevations to be surveyed include the top of protective casing, top of riser, well aprons, and ground surface. Horizontal locations will be surveyed to within 0.5 feet. Surveyed elevations and locations

will be coordinated with the existing well survey. The locations of soil borings, test pits and soil gas sampling points will also be surveyed.

Aquifer Testing Program

In-situ hydraulic conductivity testing will be conducted using two methods: slug tests and pumping tests. Rising and falling head slug tests will be conducted on each monitoring well. Only rising head tests are planned for wells that have screen zones that bridge the water table due to the inapplicability of the analytical method for a falling head test. The slug test data will be used to obtain an order-of-magnitude estimate of the hydraulic conductivity of the water bearing material immediately around the well screen and will be compared to, and used in conjunction with, pumping test data and published information. A pumping test will be conducted on-site to further define the groundwater hydrology and as an aid in evaluating contaminant fate and transport. The pumping well location and the type of test to be conducted will be determined following evaluation of the monitoring well survey and the slug test data.

A minimum of three monitoring wells located near the pumping well will be selected for collection of water level data throughout the pumping test. A constant-rate pumping test will be conducted for up to 72-hours with periodic monitoring of the water level in the pumping well and the monitoring wells during pumping and recovery. A step-drawdown test will be conducted prior to the constant-rate pumping test to determine the optimum pumping rate.

Water levels will be measured before and after the pumping test to define possible water level trends. Water level drawdown versus time data will be plotted on semi-logarithmic paper as the test is conducted to allow an evaluation of the test progress and preliminary analysis in the field. The drawdown in each of the monitoring wells will also be plotted on logarithmic paper and analyzed using the appropriate type curve fitting method. The choice of method that will be used will be based on geologic and hydrologic data obtained during well boring, installation, and development, as well as potentiometric and flow net elevations, the aquifer conditions and the character of the drawdown plots. The pumping test interpretation method shall be identified with justification in a letter report to the USEPA

WAM. Once the method of analysis is selected, the plots will be fitted to the appropriate type curves and the transmissivity and storage coefficient will be calculated.

Based on the synoptic water level measurements and the pumping test, an analysis of the aquifer transmissivity and storage coefficient, and the area influenced by pumping will be conducted. This analysis will focus on the direction of groundwater movement, both vertically and horizontally, through the upper glacial aquifer.

During the pumping test, pH, conductivity and temperature will be measured continuously using a YSI Model 3600 flow-through meter. In addition, during the pumping test a groundwater sample will be collected every 12-hours and analyzed for TCL/TAL compounds, dissolved metals, total cyanide and TDS. The results will be used to assess the contaminants in groundwater. These data are needed to evaluate groundwater treatment.

Groundwater extracted during the pumping test may be disposed of by several methods with varying costs. The method selected will depend on the anticipated yield of the well which will be estimated based on the results of the slug tests performed on each well, and the water quality, which will be based upon at least one round of sampling. The groundwater may be pumped into tankers for characterization and/or transport to an appropriate disposal facility. A temporary SPDES permit may be obtained from NYSDEC to discharge the pumped water directly to the ground or into a surface water body. Some treatment prior to discharge may be recommended depending on the chemical quality of the groundwater. For example, the pumped water may be treated with a mobile air stripping or carbon unit. Information gained from treatment during the pumping test could provide valuable information for screening alternatives during the FS.

5.3.4.5 Surface Water and Sediment Investigation

The nearest natural surface water body to the site is Glen Cove Creek, which is located along the southern boundary of the site. Glen Cove Creek generally flows into Hempstead Harbor. The Creek is a tidal estuary and therefore, flows and water quality are influenced by the tidal cycle.

The site has limited topographic relief and the patterns of surface water flow have not been identified. It is believed that most of the surface water flow on-site is collected in a system of storm drains that direct it to Glen Cove Creek through a series of outfalls (NUS Corporation, 1990). Runoff from Parcel B and other unpaved portions of the site potentially enters Glen Cove Creek by these routes. The network of existing storm drains, storm water conveyance pipes, and outfalls to Glen Cove Creek are discussed in Section 3.1.5.5. The site is located on the 100/500 year floodplain and therefore, may be subject to periodic inundation.

Two on-site surface water ponds exist: Mud Pond and one unnamed pond on the southwestern portion of Parcel B. Surface water and sediment samples have been collected in a previous investigation (NUS, 1990). Sampling locations and analytical results from this previous investigation are discussed in Sections 3.1.8.4. The depth of standing water in surface water bodies will be determined as part of the surface water and sediment investigation.

Additional investigations are necessary to fully understand the surface water flow patterns. A completed topographic survey of the ground elevations (described in Section 5.3.4.1), will aid in the determination of storm water runoff flow directions. A full inventory of surface water storm drains will be conducted. This will include floor drains located in buildings. This inventory will be focused on into the locations of storm water conveyance pipes leading to outfalls into the Glen Cove Creek. This information is needed to identify potential contaminant routes to the Creek. Because the structural integrity of the storm water conveyance system is not known, there is also a potential that cracked or disconnected pipes seated in gravel backfill are a potential source of groundwater contamination. Based upon the identification of the storm drains, soil samples will be collected adjacent to selected lines at the invert elevations (refer to Figures 5-1A and 5-1B for proposed soil sample locations).

5.3.4.6 Air Quality Investigation

An ambient air monitoring program will be undertaken to investigate whether there are any site specific volatile organic air emissions or airborne particles affecting air quality on and around the site.

Monitoring for volatile organic vapors will be conducted using an HNU photoionization meter and/or an OVA flame-ionization meter. Monitoring for airborne particulate matter will be conducted using a Miniram particulate meter. Radiation monitoring will be conducted using a Ludlum micro-R detector, or equivalent. These meters will be continuously monitoring ambient air quality during intrusive phases of the RI (e.g., boring program, groundwater sampling) to provide real-time monitoring for health and safety issues.

In addition to the air quality work described above, a baseline emission estimate of VOCs and PCBs will be performed. The estimates will then be used as input to the USEPA screening atmospheric dispersion model (SCREEN) to determine the maximum anticipated contaminant concentrations. These data can then be used for comparison with the chemical-specific ARARs for the contaminants. If the screening procedures indicate no air quality problem, then there will be no need for more refined calculations.

5.3.4.7 Meteorological Investigation

A portable wind vane/anemometer will be set up on-site during the intrusive phases of the RI to estimate the wind direction and speed. Further meteorological investigations are not planned at this time. If significant air borne contamination is detected, further meteorological data such as temperature, relative humidity, and barometric pressure, will be collected for the purpose of conducting the site health risk assessment.

5.3.4.8 Cultural Resources Survey

The field investigation will also include a Cultural Resource Survey (CRS) for a Stage 1A (Literature Search and Sensitivity Study) Survey. The scope of work and schedule will be in accordance with the requirements and procedures outlined in USEPA guidance documents (USEPA, 1989e). The Stage 1A investigation will also determine whether further cultural resource investigations (i.e., a Stage 1B study) may be needed. The Stage 1A investigation will include a literature and archival search of historical, archaeological, architectural, or culturally significant properties. The information derived from this work will be used during the FS for developing and screening remedial alternatives to avoid or

minimize effects on cultural resources. For the purpose of this survey, the study area will be confined to the site.

The primary objective is to evaluate the sensitivity of the site for the presence of cultural resources by reviewing sources at the State Historic Preservation Office (SHPO), local governments, universities, local libraries, museums, historical societies, and others as determined appropriate by the Contractor or the USEPA WAM. Individuals and organizations with historical and cultural expertise can also be included in this study, as appropriate. In addition to characterizing the nature and extent of the proposed project, an initial walk-over reconnaissance and surface inspection will be completed, and the effect of prior ground disturbance on the probability of identifying cultural resources assessed. The potential for unidentified resources will further be defined by including a syntheses of land use patterns, and prehistoric and historic cultural development of the project area, if deemed appropriate. This synthesis will aid in screening alternatives, analyzing indirect effects, and determining the need for and scope of a Stage 1B survey. The Stage 1A sensitivity study will result in recommendations for the subsequent Stage 1B investigation, if warranted.

If a Stage 1B (Site Recognition) Survey is needed, a detailed scope of work and schedule will be submitted to the USEPA WAM for approval.

5.3.4.9 Human Population and Land Use

For the purpose of the site health risk assessment, local demographic and land use data will be compiled from previous studies (EBASCO, 1991) and available data bases and updated, if appropriate. The information will be evaluated to delineate potential receptors and exposure pathways.

Information on the size, location and characteristics of the human population living within a one-half to three-mile radius of the site will be collected from U.S. Census Bureau reports and/or computer files and reports prepared by the Nassau County Planning Board. Site observations within the area will be conducted to ascertain proximity to and likely human contact with contaminated media.

5.3.4.10 Ecological

An ecological investigation of the site and adjacent properties will be conducted to characterize existing on-site conditions relative to vegetation community structure, wildlife utilization and sensitive resources such as surface waters and wetlands. This investigation will identify discernable contaminant pathways and biological/ecological related ARARs. This information, together with surface and groundwater data will be used to assess potential adverse effects resulting from identified on-site contaminants and also to assess the ecological effects/impacts of proposed remedial alternatives.

To achieve these goals, surface waters and wetlands, if present, will be defined and identified, vegetation patterns and those areas suitable for wildlife habitat will be identified and mapped. Wetlands will be formally delineated using the "Corps of Engineers Wetlands Delineation Manual" (January, 1987). Potential habitat for federal and state threatened and/or endangered species will be identified from on-site observations and available published data. Additional biological studies are not planned at this time (i.e. sampling of vegetation and animal tissues). If significant surface water, sediment, soil and/or groundwater contamination are found on the site and/or groundwater discharges to wetlands or other sensitive habitats, further biological data will be collected to enable a more quantitative Ecological Assessment. Section 5.6.2 of this Work Plan describes the proposed approach for the Ecological Assessment.

A review of existing available site data and base mapping will be conducted for the purpose of identifying the characteristics of known contaminants and their potential pathways of exposure and ARARs. Data that will be acquired and reviewed include USGS, National Wetland Inventory (NWI) mapping, the Soil Survey of Nassau County, and aerial photography. The Contractor will also request information from the U.S. Fish and Wildlife Service and the State of New York concerning the occurrence of federal and state threatened and endangered species within the project area.

Biological data will be collected for the purpose of identifying and mapping on-site ecological conditions to determine impacts and possible pathways of contaminants. Pathways leading off-site will be investigated to identify the receiving body of possible contaminants. In the event that on-site contaminants are found to be migrating off-site,

pathways and potential receptor sites (e.g., drainage basins, wetlands, water bodies) may be identified. A subsequent plan and budget for supplemental environmental analyses of off-site surface water, sediment, soils, and biota in these areas will be recommended, if applicable. As part of the off-site biological investigation, USGS topographic maps and NWI mapping will be used to identify potential off-site receptors in the areas adjacent to and down-gradient of the site. The following areas will be observed and map-located: water bodies, wetlands, open space (e.g., parks, playgrounds, undeveloped lands), habitat for threatened and endangered species. The resulting data will be used to compare off-site environmental conditions to conditions on-site.

In summary:

- Surface waters and wetlands on-site will be identified and map-located. Because overland surface flow is a potential pathway for transporting and depositing contaminants, streams/drainage courses will be identified. The direction of flow, depth of water, dimensions of the water course, and areas of deposition will also be noted. Wetlands will be formally delineated using the 1987 USACOE manual. Data on vegetation, soils, and hydrology will be recorded on the appropriate data forms, wetlands will be identified on site mapping and classified as to type.
- Vegetation patterns will be mapped, plant species identified, and percent areal cover determined for each vegetational stratum. Vegetational communities providing wildlife habitat will be noted and indicated on a site map. In addition, based on New York Fish and Wildlife data for the area, wildlife species likely to utilize specific area vegetational communities will be identified. These data will be used to conduct a comparative assessment of similar vegetational communities found off-site, if present.
- Wildlife observations will be recorded as will the presence of habitat that is likely to support Federal or State threatened or endangered species. Data collected will include the numbers of individuals observed, species utilization of the site (i.e., foraging, nesting, migratory stopper), and species utilization of vegetation stratum (i.e., open field, shrub/scrub, wooded). In addition, data supplied by New York Wildlife Resources Center will be used to identify possible habitat for documented threatened or endangered species utilizing the area. The resulting data will be used to compare species utilization of similar off-site habitats within a 1.0-mile radius of the site.

The qualitative analyses of the field study outlined above for this ecological investigation will be used in conjunction with the Ecological Assessment to determine the future need for quantitative data. An evaluation of potential biological effects of on-site remediation may demand additional quantitative data. This may require sampling and analysis to determine

the extent and concentration of contaminants in biologic tissue or specific on-site media as well as their potential adverse effects on the biological community. An Ecological Assessment as described in Section 5.6.2 will then be initiated.

While conducting the wetland delineation, observational information for application of the U.S. Army Corps of Engineers Wetlands Evaluation Technique (WET), Version 2.0. WET will be conducted to assess baseline functional values of on-site wetlands. In the event remedial activities will impact wetlands, the baseline values will be utilized to develop a wetland restoration plan.

5.3.5 Chemical Characteristics Survey

The FSP will contain information on data validation. Chemical data generated by CLP laboratories will be validated by trained and certified personnel using USEPA's Standard Operating Procedures. Selected samples in each sample category will be sent for TCLP testing. This will be done to evaluate the level of treatment required and characterize the waste material for disposal purposes.

5.3.5.1 Soil Gas Survey

Based on the existing soil gas and groundwater quality information, a total of five contaminant plumes were identified on the site (G&M, 1988; NUS, 1990). Our understanding of the origin and extent of these plumes is described in Section 3.1.8.2. Analysis of water quality samples collected in one of the plumes near the southeast corner of Parcel B detected concentrations of tetrachloroethene in monitoring well GM-3D. Three sampling events, including GM-3D in 1987, 1988 and 1990, indicate that the concentrations of tetrachloroethene have decreased with time from 9,000 ppb in 1987, to 7,400 ppm in 1988 and to 1,100 ppb in 1990. This indicates a movement or dissipation of the plume over time.

Currently, the existing monitoring well locations do not provide sufficient information on the extent and movement of the VOC plume. A soil gas survey will be conducted on parts of Parcel A where previous investigations have identified a contaminant plume to further delineate the extent of the plume and its migration. Results of the soil gas survey will be used to identify potential locations for additional monitoring wells. The additional wells will

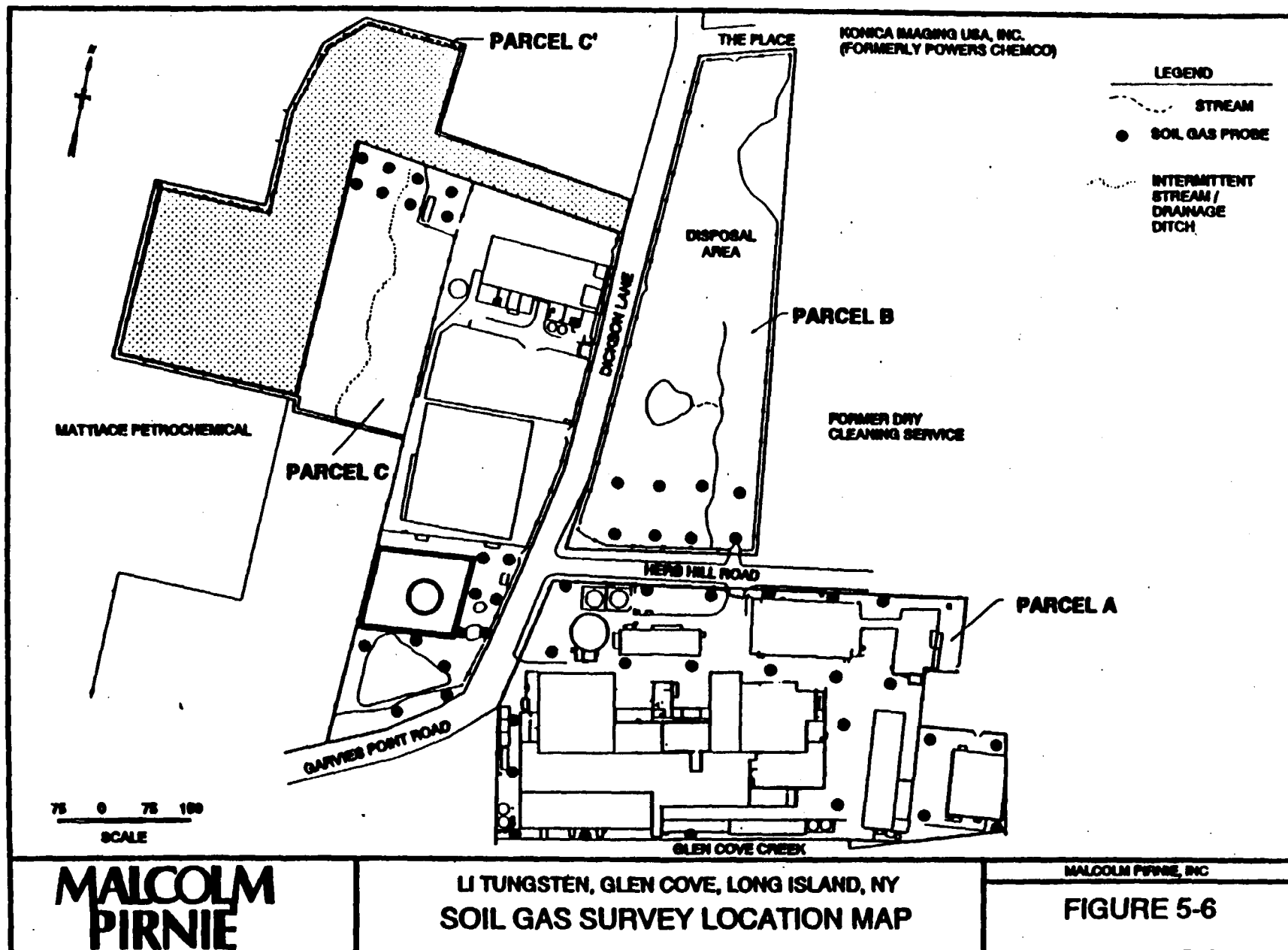
allow for continued monitoring of the movement of the plume. Proposed locations of the soil gas survey are illustrated on Figure 5-6.

Another area of VOCs in the groundwater has been identified around monitoring well GM-10. Concentrations of trichloroethylene, 1,1,1-Trichloroethane and 1,2 Dichloroethane were detected in the groundwater during previous investigations (G&M, 1988; NUS, 1990). Concentrations of these constituents increased between the 1988 and 1990 sampling events from 58 ppb to 83 ppb for trichloroethylene; from 200 ppb to 450 ppb for 1,1,1-Trichloroethane; and from 66 ppb to 87 ppb for 1,2 Dichloroethane. Results from the previous soil gas survey, however, do not indicate VOCs in the surface soil in this area. Because GM-10 has a relatively deep screen interval (54 to 44 feet below grade), and because there was no identified surface soil VOC contamination, it is believed that the VOCs at GM-10 is from an off-site source. Therefore, no additional soil gas survey is proposed in this location. A complete description of the characterization proposal for the GM-10 plume is discussed in Section 5.3.4.4 and Table 5-2.

Previous site investigations (G&M, 1988; NUS, 1990) identified two potential plumes of petroleum hydrocarbons. One plume is in the area of the oil recovery sumps west of the Dice Building on Parcel A and the second plume is in the area of the 500,000 gallon AGST. It is unclear, however, how the plume near the oil recovery sumps was identified because neither the soils nor the groundwater samples showed any indication of BTEX compounds. A soil gas survey will be conducted in the vicinity of the oil recovery sumps to investigate for petroleum hydrocarbons.

A soil gas survey will also be conducted to determine the extent of the petroleum hydrocarbons associated with the 500,000 gallon AGST. This survey will focus on areas downgradient of the previously identified soil contamination. Locations for the soil gas surveys are shown on Figure 5-6.

Based on the findings of the soil gas survey, additional shallow wells may be recommended as part of a Phase II program to monitor groundwater quality in the two areas. Soil samples taken during well installation may be analyzed to determine the extent of soil contamination in the vadose zone. This information may be used to determine whether VOCs detected during the soil gas survey are originating from the groundwater or the soils in the



unsaturated zone. Delineation of vadose zone contamination may require additional soil borings and chemical analyses in the affected areas.

5.3.5.2 Groundwater Sampling

Groundwater samples will be collected from new and existing monitoring wells and analyzed to obtain data on groundwater quality on and around the site. Two rounds of groundwater sampling are proposed. One sampling event is proposed in the summer when groundwater levels are typically low; the other sampling event is proposed during the winter months when groundwater levels are generally high. Two separate sampling events will provide information on potential seasonal variations in contaminant concentrations. Water levels will be measured and recorded before purging the wells. A minimum of three well volumes will be purged from each well, using a submersible or centrifugal pump or bailer, before collecting samples. The type of pump used will depend upon the depth to water. If the depth to water is greater than 20 feet, a submersible pump will be used. If the yield is low, the well will be purged by bailing. Regardless of the purging method used, care will be taken to avoid purging the well to dryness, which can cause loss of volatile organic compounds from the groundwater entering the well. Samples will be collected a minimum of two weeks after the wells are installed and developed to allow for stabilization. The samples will be analyzed for TCL/TAL, dissolved and total tungsten, total cyanide, total dissolved solids (TDS) and radiological parameters (^{232}Th , ^{230}Th , ^{226}Ra , ^{228}Ra , and ^{235}U). pH, conductivity, and temperature of the groundwater will be measured in the field.

Groundwater samples will be collected using a Teflon or stainless steel bailer. Filtered and unfiltered samples will be collected for dissolved and total metals analyses. Descriptions of well purging and groundwater sampling procedures, containers, preservation, holding times, and other details will be included in the FSP.

5.3.5.3 Soil Sampling

Test Pit Sampling

Test pits will be excavated to investigate the subsurface extent of the disposal area located on Parcel B. Soil samples will be collected during test pit excavation to determine if soils are contaminated and represent a potential source of groundwater contamination.

The soil samples will be screened with a photoionization detector and a GM pancake detector. Samples which show the greatest response on the field instruments or show visible evidence of contamination will be sent to the laboratory for chemical and/or radiological analysis. The remaining samples will be archived for future reference. A minimum of two samples per test pit will be collected for analyses. The actual number of samples may increase based on field conditions. The test pit soil samples will be analyzed by a CLP laboratory for TCL/TAL, Total Organic Carbon (TOC), pH, and tungsten. Radiological parameters will possibly require analysis by a non-CLP laboratory. TCLP analysis will be conducted on two composite waste material samples to classify the buried waste. Additional sampling and analysis may be required pending results of the TCLP analysis. Figure 5-2 illustrates test pit sampling locations.

Well Boring Sampling

Continuous split spoon samples will be collected during the drilling of each new monitoring well. A minimum of two samples per borehole will be sent to the CLP laboratory for chemical analysis. All split spoon samples will be screened in the field with a photoionization detector and a GM pancake detector. Samples which show the greatest evidence of contamination will be sent to the laboratory for analysis. If the field screening procedure does not show evidence of contamination, then one sample will be collected from 6 to 12 inches below the ground surface and one from 6 to 12 inches above the water table. Chemical analysis will include TCL/TAL, TOC, pH and tungsten. This analytical approach will provide an indication of the vertical extent of contamination in the unsaturated zone at each location.

Soil Boring Sampling

A soil boring program will be conducted at two general locations; one in the vicinity of disposal activities on Parcel B to establish the vertical extent of buried waste, and the second along selected storm and process drainage lines to determine whether the drainage system acts as a conveyance for contaminants to enter the groundwater.

Soil samples from borings drilled in the disposal area will be analyzed for TCL/TAL, TOC, pH, tungsten and radiological parameters at depths where contamination is suspected (based on photoionization screening, radiological screening or visual identification of wastes) and in natural unsaturated material beneath the waste to a maximum depth of 6 to 12 inches above the water table. One soil sample from each area will be sent for TCLP analyses. If different types of contamination are found, then additional TCLP samples may be collected to characterize each waste type encountered.

Soil samples from borings drilled adjacent to the storm sewer system will be analyzed for TCL/TAL, TOC, pH and tungsten. Soil samples will be collected at a depth of one foot below the invert elevation of the storm water discharge lines. Additional samples will be collected adjacent to storm drains. The locations and elevations of the storm sewer system and storm drains will be obtained from records of previous storm water discharge permits, the Nassau County Department of Public Works and field reconnaissance.

5.3.5.4 Sediment Sampling

Sediment samples previously collected and analyzed by showed PCB contamination in the Mud Pond and two Mud Holes (NUS, 1990). The reported concentrations were in excess of NYSDEC corrective action criteria and warrant further investigation.

New sediment samples will be collected in Mud Pond, the two Mud Holes and the pond on Parcel B to confirm the presence of PCBs within these features. Sediment samples will be analyzed for TCL/TAL compounds, TOC, pH, tungsten, radiological parameters and grain size distribution. Based upon the results of the sediment analyses, additional sampling may be required to delineate the vertical and horizontal extent of PCB contamination. Elevated concentrations of numerous metals were also detected in the majority of the NUS sediment

samples. Sediment samples will be collected at the same sample locations to confirm the presence and assess possible changes in metal concentrations since the 1990 sampling event. Sampling locations are shown on Figure 5-7. Note that the alphanumeric sample designation used by NUS is retained for ease of reference. No sediment sampling in Glen Cove Creek is proposed as part of this Work Plan as requested by USEPA. Glen Cove Creek sediments are currently being sampled as part of the Mattiace RI.

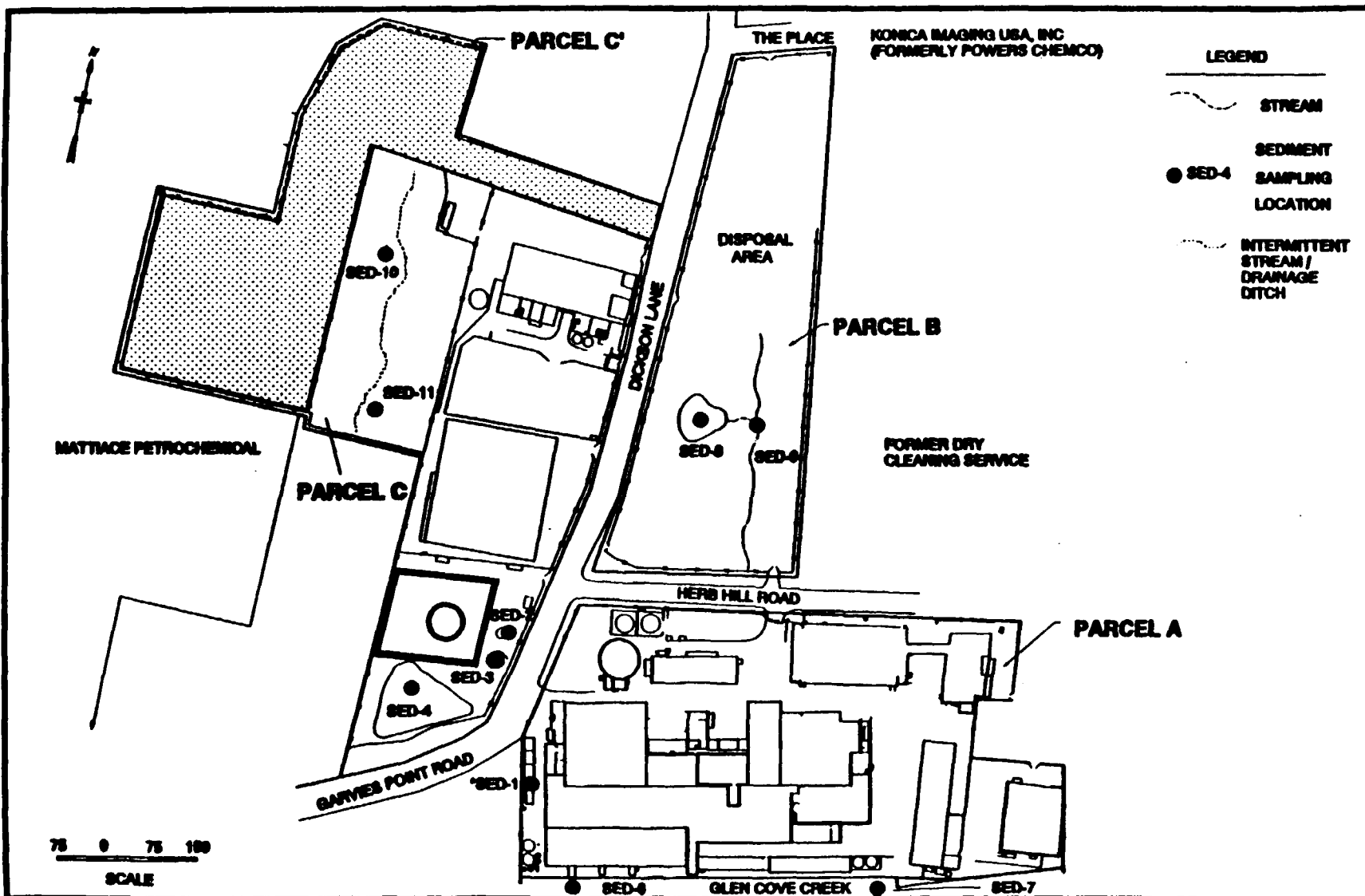
A previously unmapped and unsampled intermittent stream/drainage ditch was identified on Parcel C during the February 1993 site visit. This feature appears to receive surface water flow draining off the area of scarred vegetation and other areas on Parcel C at higher elevations. Two sediment samples are proposed along the course of this channel.

5.3.5.5 Surface Water Sampling

Eleven surface water samples previously collected identified metals and non-metal inorganic compounds (NUS, 1990). To confirm the presence of the inorganic contamination in the surface water on the site, new surface water samples will be collected at the same locations used previously, as shown in Figure 5-8. Ten surface water samples will be collected, (NUS collected 11 surface water samples; however, NUS samples *SW-1 and SW-3 were collected from the same location). Note that the alphanumeric designations used by NUS has been retained for ease of reference. These data will provide information on possible changes in concentrations over the time period between sampling events. Surface water samples will be analyzed for metals and non-metal inorganic compounds. Field parameters, including temperature, pH, and specific conductance of surface water samples will be measured at the time of collection.

Two surface water samples are proposed along the intermittent stream/drainage ditch on Parcel C since this area has not been previously sampled.

If a significant increase in the surface water contamination is identified compared to previous investigations, a more in depth sampling program, including biota and sampling of the outfalls to the Glen Cove Creek during precipitation events, will be necessary. At



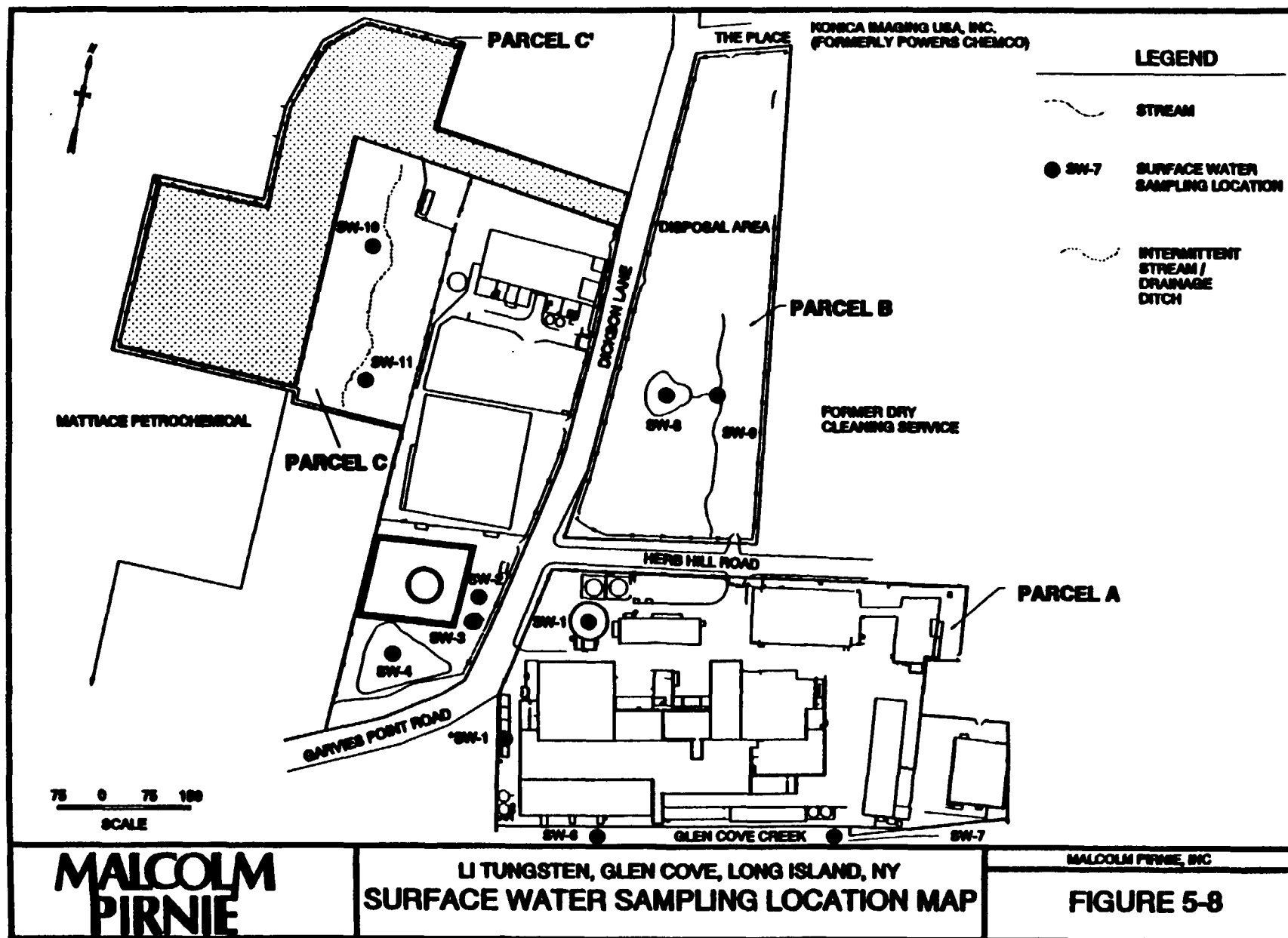
**MALCOLM
PIRNIE**

**LI TUNGSTEN, GLEN COVE, LONG ISLAND, NY
SEDIMENT SAMPLING LOCATION MAP**

MALCOLM PIRNIE, INC

FIGURE 5-7

300679



present, no surface water sampling of Glen Cove Creek is proposed as requested by USEPA because the creek is currently included in the existing sampling program as part of the Mattiace petrochemical site investigation.

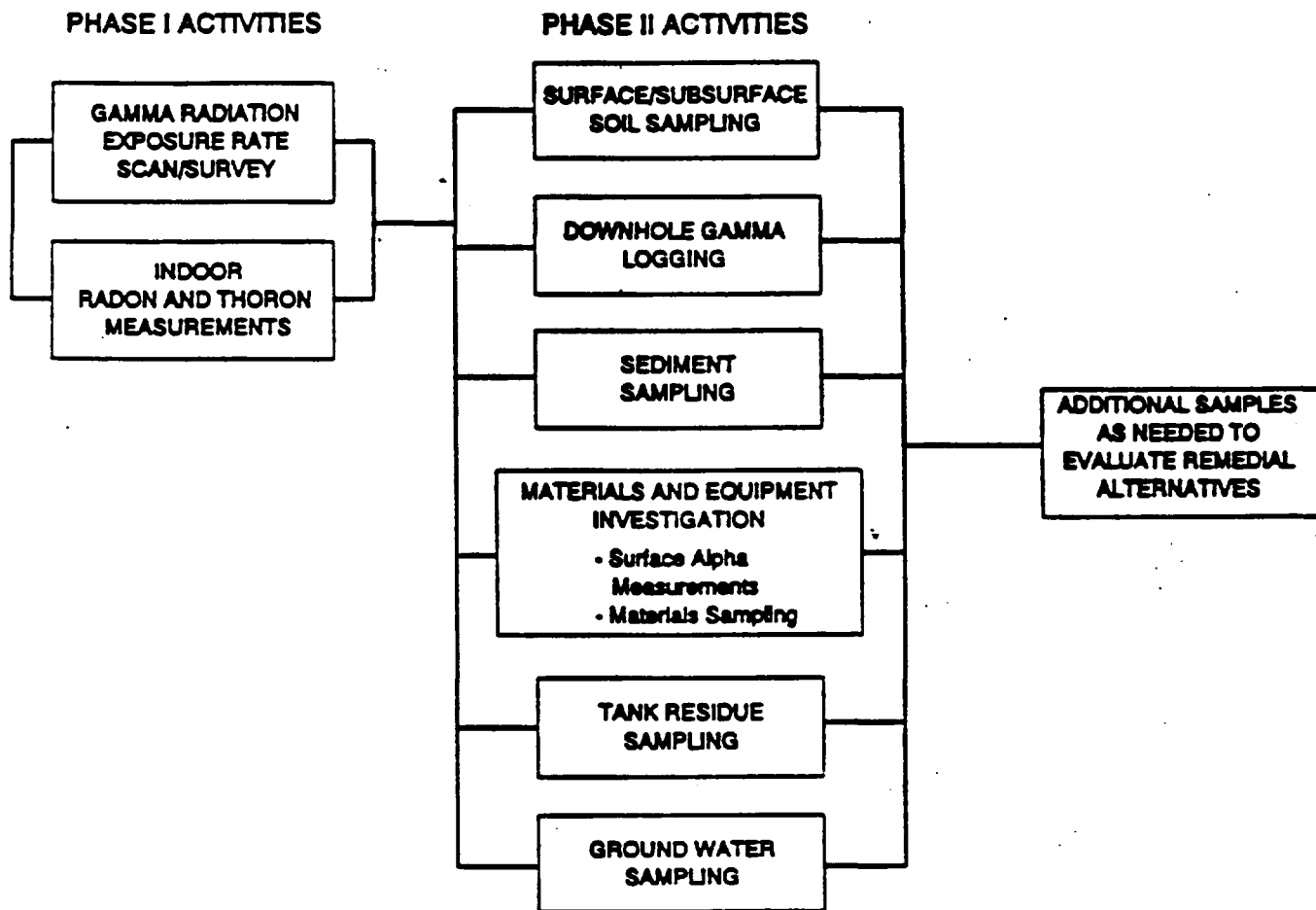
5.3.6 Radiological Characterization

The radiological assessment included a comprehensive exposure rate survey, materials (e.g., soil, process materials, sediment, asphalt, and tank contents) sampling for uranium series and thorium series radionuclides, indoor radon and thoron measurements, and surface alpha surveys of building materials and equipment (NDL, 1989).

Prior to the implementation of field activities proposed in this Work Plan, interim remedial actions will have removed significant quantities of soil and process materials containing elevated concentrations of Naturally Occurring Radioactive Material (NORM) from their current locations in buildings and on courtyard areas. The removal of these materials will allow for a more detailed radiological investigation of the buildings, including an evaluation of any subsurface radiological contamination.

Further characterization of radiological conditions will build on the previous database. Measurements need not be repeated in areas where data were collected and conditions have remained the same. For example, there is no need to perform a gridded gamma exposure rate survey in outdoor, wooded areas surveyed since no materials have been excavated from those portions of the site.

The field investigations have been segmented into Phase I and Phase II activities. The objective of the radiological survey is to characterize the location, quantity, and types of radioactive contaminants in soil, process materials, equipment, building materials, and tanks. Activities including screening measurements (Phase I) as well as detailed characterization of the radionuclide concentrations in these media (Phase II), as shown in Figure 5-9. The activities are described below.



**RADIOLOGICAL
CHARACTERIZATION FLOW CHART**

5.3.6.1 Phase I Measurements

Gamma Exposure Rate Scan/Survey

The previous exposure rate survey of the entire site showed that ambient exposure rates range, in general, from 10-30 $\mu\text{R/h}$, with levels from 50-500 $\mu\text{R/h}$ along the surface of the piles of waste material (NDL, 1989). Four areas as yet not remediated remain on the site with relatively high levels of gamma radiation. A heavily vegetated area on Parcel C has exposure rates ranging from 3-5 mR/h. A pile of slag rocks on the north side of Parcel C has readings ranging from 1-3 mR/h. A pile of large rocks along the northern Parcel A fence is also the source of exposure rates in the 1-3 mR/h range, and a 300 $\mu\text{R/h}$ area near the ground surface on the uncontrolled side of the Parcel A fence.

Outdoor deposits of process material/soil containing elevated concentrations of NORM were identified in these and other areas. Areas which have not been remediated or otherwise disturbed need not be resurveyed. However, the gamma surveys conducted inside buildings need to be repeated once the radioactive soil/slag/process materials have been removed. First, the entire floor surfaces and walls (where accessible) will be scanned with a NaI detector. If exposure rates exceed two times the background rate, then the area involved will be surveyed following a 10 foot by 10 foot square grid system. Readings will be taken at the surface and at 1 m height at the grid line intersections. The areas within the sample points will be surveyed; exposure rate maxima will be recorded (along with their coordinates).

The exposure rate data will be used to identify any subsurface deposits of radioactive material beneath the buildings. Soil sampling and gamma logging locations (described below) will be based, in part, on the gamma exposure rate survey measurements.

For quality control purposes, readings will also be taken with a Pressurized Ion Chamber (PIC). PIC data will be used to perform an "in-field" calibration of the NaI detectors utilized in the gamma surveys.

Where accessible, the surfaces of equipment and tanks will also be scanned with the GM pancake detector. Elevated count rates will indicate where tank surfaces and/or residues contain radioactive contaminants. These data will be evaluated and used to determine if

samples of materials or tank contents should be sampled for thorium, radium, and uranium content.

Short-term Radon/Thoron Measurements

Due to the dilapidated condition of most buildings on the site, it is unlikely that elevated concentrations of radon and/or thoron gas present a health and safety concern to workers. Radon and thoron samples were collected from the East, West, and Central Dice Buildings. None of the measurements were elevated; all results were less than 2 pCi/L. However, at the outset of field activities, short-term measurements will be collected to document the levels of these radioactive gases. In the event that elevated levels are measured, appropriate measures will be implemented by the site health physicist.

5.3.6.2 Phase II Measurements

Surface Alpha Measurements

Alpha particles emitted from the surface of materials during the decay of ^{232}Th and other radionuclides present at the site may be detected with a hand held alpha scintillation detector. The detector measures the amount of total surface alpha activity. Removable alpha activity may be measured by wiping an area of approximately 100 cm² with a small piece of filter paper. The paper is then counted in an alpha sample counter or gas proportional counter.

Total and removable surface alpha particle measurements were performed during the radiological characterization of the site. The ore dust sampled throughout the site did not show any significant radioactivity. Surface contamination was seen in only a few areas. Some steel vats in the mixing room of the Dice Building and one empty steel tank near the East Building with an open inspection port had total alpha contamination levels of 4000 to 8000 dpm/100 cm². Many other tanks and vats exhibited elevated levels of gamma radiation and therefore probably have internal surface contamination, although their contents were not surveyed. In addition, a patch of asphalt situated between the East Building and the Wire Department Area was found to be contaminated with up to 4500 dpm/100 cm².

As a result of the surface alpha survey, a comprehensive alpha survey will not be conducted as part of this RI. Portions of tanks (especially the inside of tanks which were not previously accessible) and any equipment found to be the source of elevated gamma radiation, however, will be surveyed for surface alpha contamination.

Soil Sampling/Downhole Gamma Logging

Several outdoor areas were identified as having mounds and/or subsurface deposits of soil/slag/process materials with elevated concentrations of ^{232}Th and other radionuclides. Surface soil samples from some of these locations were collected and analyzed for ^{232}Th , ^{226}Ra , and ^{238}U . In general, ores and intermediate process materials ranged from 15-30 pCi/g for these three radionuclides. Materials believed to be waste products were sampled from all three parcels and contained up to 1000 pCi/g ^{232}Th . Many soil samples were collected along the site perimeter and were found to contain background levels of uranium and thorium series radionuclides (e.g., approximately 1 pCi/g). However, some soil samples contained up to 300 pCi/g ^{232}Th . Soil maxima of 144 pCi/g and 104 pCi/g were measured for ^{238}U and ^{226}Ra , respectively.

Additional sampling of surface as well as subsurface soil/slag/process materials, in combination with downhole gamma logging of boreholes, will be utilized to define the extent (e.g., depth and volume) of radiological contamination (e.g., ^{232}Th , ^{230}Th , ^{226}Ra , ^{228}Ra , and ^{238}U concentrations) of these materials. Borehole locations will be selected to coincide with areas exhibiting elevated gamma exposure rates. If elevated exposure rates are observed through a building floor, drilling and soil collection will also be done inside of buildings. Approximately 20 boreholes will be drilled at biased locations.

Boreholes will be drilled to 15 feet using either the air rotary or the hollow stem auger method. Soil samples will be collected with 2 inch diameter split spoons. The contents of each spoon will be scanned with a GM pancake detector to identify segments exhibiting enhanced radioactivity. Samples will be collected of the soil exhibiting elevated radioactivity as well as of the soil located directly beneath the contaminated material. In this way, the soil sample data will reveal both the extent and depth of radionuclide concentration.

Following collection of the split spoon samples, a hollow piece of PVC piping, capped at one end, will be inserted into the hole. Downhole gamma logging will be performed by taking 30 second count rate readings at 6 inch depth increments, beginning with the surface. The profile of gamma radiation intensity will be used to estimate the depth of contamination within the immediate vicinity of the hole.

It is quite possible that much of the contaminated material in the vegetated portions of the site (i.e., Parcels B and C) reside in the upper few feet of soil. Where this is the case, a significant amount of data will be collected via additional downhole gamma logging to a depth of 5 feet. Hollow steel tubes of up to 5 feet in length will be driven into the ground with a jackhammer at "hot spots" and at suspected boundaries of the contaminated materials deposit. Downhole gamma logging measurements will be taken with a NaI scintillation detector (3/8" x 3/8" or 1/2" x 1/2" crystal) coupled to a portable ratemeter/scaler. When evaluated with surface exposure rate measurements, it is possible to estimate the volume of contaminated material contained within the deposit.

Sediment Samples

Previously sampled sediments from each of the pond areas and found very little, if any, contaminant migration away from nearby mounds of material with elevated concentrations of radionuclides. Pond sediments need not be sampled unless elevated gamma exposure rates are found to be emanating from them.

Building Materials Samples

Existing data indicate that the building structural components and factory equipment are not significantly contaminated with radioactive materials. However, some sampling will be conducted based on the gamma radiation scans/surveys of building floors and walls, which will identify potentially contaminated materials. Areas identified with elevated exposure rates will be targeted for sample collection. In most cases, samples of concrete walls or floors will be collected by chipping pieces with a jackhammer or other suitable tool. The samples will be analyzed for ^{232}Th and other members of the uranium and thorium decay series. Similarly, any outdoor areas with contaminated asphalt, such as the one found during the radiological investigation, will be sampled for radionuclide content.

Tank Residues

Several large steel and wood tanks emit gamma radiation levels ranging from 30-100 μ R/h (NDL, 1989). Exposure rates at the surfaces of some tanks could not be accurately quantified due to the elevated ambient radiation emitted from nearby piles of process materials and slag. Contents of some of the tanks were sampled and found to contain very low radionuclide concentrations. Apparently, the walls or residues clinging to the inner walls of these tanks are the sources of the radiological contamination.

Characterization of radionuclide contents in all of the tanks will be performed during the RI. The objective of the tank sampling will be twofold: (1) to determine whether each tank would require disposal as radioactive waste in its current condition, and (2) to evaluate the possibility of decontamination of radioactivity from interior tank surfaces. Exposure rates will be measured at the tank surfaces following the removal of the contaminated soil/slag/process materials currently on-site. All tanks appearing to be the source of elevated radioactivity will be subject to extensive radiological sampling. Where possible, internal walls should be surveyed with alpha scintillation detectors and GM detectors. If present, samples of residue will be collected for radiological analyses (^{232}Th , ^{230}Th , ^{226}Ra , ^{228}Ra , and ^{238}U). Samples will also be collected of the actual tank material (e.g., steel or wood) for radionuclide analyses.

Groundwater Sampling

Groundwater will be sampled to determine (1) whether radiological contamination has infiltrated the underlying aquifer, and (2) to evaluate any off-site migration of radionuclides.

Preliminary plans call for assessment of the existing wells on-site. Water samples will be collected from all rechargeable wells and analyzed for isotopes of thorium, radium, and uranium. At a minimum, wells will be sampled downgradient of the locations with extensive radioactive contamination.

5.4 TASK 104 - SAMPLE ANALYSIS/VALIDATION

Environmental samples collected as part of Task 103, Field Investigations (Section 5.3), will be analyzed through the USEPA CLP for Routine Analytical Service (RAS) and Special Analytical Service (SAS) parameters, and through a subcontract non-CLP laboratory for radiological parameters which are not included in the CLP parameters. The analytical results will be validated. The data validation protocols will be in accordance with the USEPA Region II procedures outlined in the latest edition of the Region II CERCLA Quality Assurance Manual, for TCL/TAL data (USEPA, 1989f) and updated (USEPA, 1992). The QA/QC procedures outlined in the manual will be incorporated into the FOP. Radiological (non-CLP) data will be validated in accordance with the protocols approved by the USEPA Region II for the U.S. Radium site (see Appendix C). The validation program will verify that the analytical results were obtained following the specified protocols, meet the DQOs, and are of sufficient quality to be relied upon in performing the risk assessment, performing the selection and screening of potential remedial action alternatives, and to support a Record of Decision (ROD).

5.4.1 Radiochemical Analysis

As described above in Section 5.3.6, soil, sediment, water, tank residue, and building material samples will be collected for radionuclide analyses. A radioanalytical laboratory will be procured prior to the onset of the field investigations for this task. Samples will be transported to the lab, where they will be analyzed for thorium, radium, and uranium isotopes via radiochemistry/alpha spectrometry and radon emanation techniques.

Samples of air particulate collected during intrusive field activities such as soil boring and sampling and installation of wells will be analyzed in the field for total alpha activity by counting the filter in an alpha particle sample counter coupled to a ratemeter/scaler. A comparison of these data to background levels will be used to assure that field activities do not pose a health hazard to on-site workers and to the residents in the surrounding neighborhood.

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All buildings will be monitored for indoor radon for at least a period of three months with an alpha track etch detector or a long-term electret/E-PERM system. The radon measurements will be conducted by a successful participant in the USEPA Radon Measurement Proficiency Program (RMPP). Characterization of indoor radon concentration will provide the means to estimate the exposure to and risk from alpha particle irradiation to sensitive human receptors, such as bronchial epithelium.

5.4.2 Chemical Analysis

Soil samples will be analyzed for chemical substances known to have been used in or are byproducts of tungsten smelting operations. The residual byproducts of the tungsten ore treatment processes and the major constituents of concern are located in Table 3-20. Surface water and groundwater samples will be analyzed for the same parameters as for soils, and also for pH, temperature, and specific conductivity.

Chemicals have been handled at the site since the cessation of Tungsten ore smelting operations. Therefore, soils, surface water, and groundwater will also be analyzed for TCL/TAL parameters by a subcontract non-CLP laboratory. A non-CLP laboratory needs to be used as the samples are expected to contain radionuclide contamination beyond levels allowed in the CLP TCL/TAL scope of work; however, every effort will be made to subcontract the analytical work to a CLP-equivalent laboratory capable of producing CLP deliverables.

5.4.3 Data Validation

5.4.3.1 Validation of CLP-Equivalent Data

Samples collected during the field investigation and analyzed through the CLP will be validated using the procedures outlined in the following USEPA Region II documents (and any subsequent updates):

- Laboratory Data Validation, Functional Guidelines for Evaluating Inorganics Analysis, October 1989 Revision (USEPA, 1989g)
- CLP Organics Data Review and Preliminary Review, SOP No. HW-2, Revision No. 7, March 1990 (USEPA, 1990).

- Evaluation of Metals Data for the CLP, SOP No. HW-4, Revision No. 10, February 1990 (USEPA, 1990b).
- USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, Multi-media, Multi-concentration (OLM01.0) and Low Concentration Water (OLC01.0), December 1990, Revised June 1991. (USEPA, 1991b)

Validation of analytical data will be conducted by personnel trained and certified by USEPA Region II. The results of the data validation will be presented as an appendix to the RI report.

5.4.3.2 Validation of Non-CLP Data

Samples collected during the field investigation and analyzed through the non-CLP laboratory(ies) for radiological parameters will be validated using the USEPA Region II protocols and procedures approved for the U.S. Radium site RI/FS project (Appendix C).

5.4.4 Field Sampling Plan

The samples collected during the field investigation will be analyzed for the parameters described in Task 103 (Section 5.3). Additional information on sample collection, analytical methods, detection limits and QA/QC samples will be provided in the FSP. The FSP, will cover the following topics:

- Objectives of sampling design and selection of representative sampling sites;
- Sampling design, including QA/QC sampling;
- Selection of parameters to be measured;
- Selection and preparation of sampling equipment;
- Sampling equipment construction materials;
- Required sample volumes;
- Selection and preparation of sample containers;
- Sample collection and handling;

- Sample preservation;
- Sample chain-of-custody and identification;
- Sample trip report;
- Use of field instrumentation;
- Field Quality Control samples; and
- Laboratories selection and data validation requirements.

The proposed analytical program includes QA/QC samples required by USEPA Region II, such as duplicates, field blanks, trip blanks and matrix spike/matrix spike duplicates. Duplicate samples will be analyzed at a minimum frequency of 5% (1 in 20 samples). Field blanks will be taken on each sampling day for each matrix and each analytical parameter or group of parameters such as TCL volatile organics, semi-volatiles, etc. Duplicate samples and field blanks will be analyzed for the same parameters as the original samples. Trip blanks will accompany each sample batch requiring analyses for TCL volatiles and will be analyzed for TCL volatiles only.

5.4.5 Sample Tracking

Sample tracking consists of the arrangements for and allocation to the designated CLP and non-CLP laboratories. The task includes assuring proper documentation and transportation of the samples to the laboratories, communication with organizations such as the USEPA Region II ESD/MMB, and RSCC dealing with laboratory booking and assembly of analytical data packages as they are received.

Sample tracking will include the following activities:

- Scheduling the CLP Special Analytical Services with the USEPA Region II Regional Sample Control Center (RSCC);
- Selecting procedures to be used by laboratories providing SAS service
- Interacting with the RSCC, the Sample Management Office (SMO), field personnel and others involved in the sample collection and analysis; and

- Organizing analytical data packages as they are received.

5.5 TASK 105 - DATA EVALUATION

The data collected under Task 103 will be organized and analyzed to permit full assessment of the requirements for the interim remedial and removal actions; the geology and hydrogeology of the site; and the nature and extent of chemical contamination in all media and exposure pathways. Previously collected data will be incorporated into this analysis as appropriate to provide a complete site assessment. However, the interpretation of data collected under task 105 will be carried out independently of any interpretations made as part of previous investigations. When possible and as they become available, the evaluation of new data generated by this investigation will be performed concurrently with Tasks 103, 104 and 106, with the goal of expeditiously preparing the Draft RI Report (Task 108). Assessing the data as it is collected will permit early identification of any data gaps and data quality issues which must be addressed prior to completing the RI.

The first phase of data assessment will be performed to assess the requirements for the interim remedial and removal actions recommended in Section 3.7 of this Work Plan. The assessment will include identification of the specific sources and extent of above ground wastes, drums, debris, tanks, collapsed building wastes, demolition wastes, and other materials such as unprocessed ore and ore slag, and asbestos removal. The results of this assessment will be used as the primary basis for developing plans and specifications for the interim remedial and removal actions recommended in Section 3.7 of this Work Plan.

The second phase, which is not necessarily sequential, will be performed to assess the geology and hydrogeology of the site. Data from field investigation tasks relating to this assessment will be compiled before initiating the second phase assessment. Features identified during the Surface Investigation will be located on site maps and described to permit correlation with and impacts to the site hydrogeology. Geologic logs from the soil boring and monitoring well installation program, data from the test pit program and the results of laboratory analyses of the physical characteristics of the soil will be used to construct geologic cross-sections and/or fence diagrams to correlate stratigraphic units across the site. Samples of the geologic logs and sample collection logs to be used during

this RI are presented in Appendix D of this Work Plan, and will be included in the FSP where it is more appropriate.

Water level data collected from monitoring wells, piezometers and surface water bodies will be entered into a Lotus 1-2-3 database in tabular format to allow for the comparison of measurements obtained on different dates and calculation of water elevations. Groundwater and surface water elevations will be plotted on site maps and groundwater elevation (potentiometric) contours drawn to estimate the direction of groundwater movement. Separate contour maps will be constructed for each water level measurement event for wells and piezometers screened in the overburden and wells screened in the bedrock. Flow net sections will be constructed to compare shallow and deep water levels. The flow net sections will be approximately parallel to the flow direction indicated by the potentiometric surface.

Slug test data will be downloaded in table form from the data logger used to conduct the test. The data will then be entered into a computer program which performs several accepted analytical methods for slug test data to determine the hydraulic conductivity of the water-bearing zone monitored by each tested well. The computer program used will be subject to approval by the USEPA WAM. Water level data collected during the pumping tests also will be tabulated either by downloading directly from the data logger, if used, or by entering onto pumping test water level forms such as that presented in Appendix D. The data will then be graphed to permit determination of the aquifer transmissivity and storativity using a method approved by the USEPA WAM. Data on the hydraulic characteristics of each water bearing zone from each test location will be tabulated and compared to provide an understanding of the rate of groundwater flow at the site.

The third phase of data assessment will be performed to assess the nature and extent of the chemical contamination in the various media and exposure pathways at the site. After data validation, groundwater, surface water, sediment and soil analytical results will be entered into a Lotus 1-2-3 database in tabular format. This will allow for the comparison of measurements obtained on different dates, at different locations and/or in different media. Analytical results will also be compared to the USEPA Office of Research and Development Treatability Study Database to determine if a treatability study should be recommended, as discussed in Section 5.7 of this Work Plan. Contaminant concentrations will be mapped and contoured (if appropriate) to illustrate their distribution in the various media across the site;

individual maps will be prepared for distinct hydrogeologic units. The geochemical properties, including breakdown products, of contaminants detected will be considered to help evaluate potential sources of the contaminants and their behavior in the environment. Data from the hydrogeologic characterization of the site will be integrated with the analytical results of various media to aid in identifying contaminant sources, migration rates and migration routes.

The human population and land use investigations and environmental assessment will then be considered relative to the hydrogeologic and chemical characterization of the site to identify potential receptors. This assessment will permit development of a refined site model which will be the basis for the risk assessment performed under Task 6 (Section 5.6). The results of the data evaluation and risk assessment will be discussed in the RI report. The site model will also be the basis for the Feasibility Study (FS) prepared in Tasks 109, 110 and 111 (Sections 5.9 - 5.11 in this Work Plan).

Preparation of the data collected during each field investigation task in tables, figures, graphs or maps as described above will facilitate review and evaluation. These tables, figures, graphs and maps will be presented in the Draft RI Report. In addition, all original data (such as validated chemical analyses, geologic boring and well construction logs, physical soil sample analyses and water level and pumping test data) will be presented in appendices to the Draft RI Report.

5.6 TASK 106 - ASSESSMENT OF RISK

Baseline human health evaluation and ecological risk assessment will be conducted to characterize the health risks associated with site contamination that would prevail, currently and in the future, in the absence of remedial action. The evaluation will follow guidance contained in the USEPA's Risk Assessment Guidance for Superfund. Volume I. Human Health Evaluation Manual (Part A) (USEPA, 1991a; 1989a) and Risk Assessment Guidance for Superfund. Volume II. Environmental Evaluation Manual (USEPA, 1989b). These are companion documents to the RI/FS guidance document, (USEPA, 1988a). The environmental risk assessment will also follow guidance contained in New York State's Fish and Wildlife Impact Analysis (NYSDEC, 1991).

It is assumed that any new data generated will be approved by the USEPA in terms of QA/QC and data validation requirements. It is anticipated that the risk assessment described below will rely on valid environmental data from previous investigations as well as data collected from this RI.

5.6.1 Human Health Evaluation

Key decision items will include:

- the rationale and selection of chemicals and radionuclides of concern;
- the potential exposure pathway matrix and inclusion/exclusion analysis;
- the exposure equations and input variables; and
- the toxicity criteria with which to characterize risks.

The human health evaluation will comprise the following components:

Hazard Assessment: Chemical contamination detected in all environmental media during the RI and valid data from previous investigations will be evaluated for selection for detailed analysis. Medium-specific chemicals of concern will be selected on the basis of frequency of detection (i.e., in greater than 5 percent of the samples, with samples sizes of 20 or more), comparison to background levels (e.g., for the naturally-occurring radionuclides and inorganic chemicals) comparison to ARARs (e.g., federal and state MCLs) and, as necessary, a maximum concentration/toxicity screen to assess the likely contribution of individual chemicals to site-specific risks. Inorganic chemical concentrations detected in soils and sediments will be compared to concentrations typical of southern New York State soils, while PAH levels in soils will be compared to levels typical of soils in urban areas. Chemicals at concentrations below these criteria will not be regarded as of concern. Other chemicals detected at the site would be anthropogenic in origin and without background (hence, comparison with background is not a screening mechanism for these chemicals). The chemicals and radionuclides of concern, which will be representative of the types of contamination present at the site, will be evaluated quantitatively in the ensuing evaluations of human health risk. The risks associated with potentially cancer-causing and noncarcinogenic chemicals will be assessed.

Toxicity Assessment: Critical evaluation and interpretation of toxicological data for the chemicals of concern will be provided. The intent is to indicate the intrinsic toxicity of the chemical, i.e., its ability to pose potential hazards to human health. Brief toxicity profiles will be prepared for those chemicals of concern found to pose the greatest health risks. Sources of toxicological guidance information, in order of preference, include: (1) IRIS (Integrated Risk Information System) which is a USEPA database containing current health risk and regulatory information for many chemicals; (2) USEPA Health Effects Assessment Summary Tables (HEAST) which are tabular presentations of toxicity data and include carcinogenic slope factors for radionuclides; and (3) the USEPA Environmental Criteria and Assessment Office. The toxicological profiles prepared by the Agency for Toxic Substances and Disease Registry (ATSDR), which contain general toxicity information and levels of exposure associated with lethality, cancer, genotoxicity, neurotoxicity, developmental and reproductive toxicity, immunotoxicity and systemic toxicity, will also be consulted. For potentially cancer-causing chemicals, the evidence supporting such a classification will be noted and the derivation of the carcinogenicity potency estimates will be summarized. Human health-based criteria, such as verified reference doses (RfDs) and slope factors for carcinogenic chemicals will be tabulated, as appropriate, for later risk characterization.

Exposure Assessment: Exposure assessments will be conducted to identify actual or potential pathways of human exposure, characterize potentially exposed human populations, and where possible, quantify the exposure of affected populations. Actual or potential exposure pathways, identified by a source and mechanism of chemical release, an environmental transport medium, a point of potential contact and an exposure route, will be evaluated in the exposure assessment. All potential exposure pathways will be identified and a rationale will be provided for inclusion or exclusion of each pathway in the baseline health risk assessment. An inventory of groundwater and surface water uses in the vicinity of the site will be conducted; this information will be factored into the rationale for inclusion or exclusion of a pathway in the risk assessments.

Potentially exposed populations will be characterized with the intent of determining whether there is potential for casual contact or intake of the chemicals and/or radionuclides. This characterization will include estimates of the ages of people potentially exposed at each exposure point and identification of human activity patterns which may influence exposure. Based on our current understanding of the site, a conceptual site model has been prepared

as Figure 3-2. This model was developed based upon the assumption that interim remedial measures would precede the remedial investigation, removing imminent site hazards. However, if this is not the case, the list of potential receptors may be more extensive, currently and in the future, including trespassers, recreational users of the Creek and Hempstead Harbor, firefighters and residents in the vicinity of the site.

In the analysis, the potential for ingestion and direct contact with contaminated soils, surface water and sediment will be evaluated. The potential for fugitive dust representing an inhalation pathway will also be evaluated. Following a qualitative air pathway analysis (i.e., considering soil concentrations, soil erosion potential, natural barriers/buffers, etc.), a decision will be reached regarding the need to derive emission rates and model atmospheric dispersion. The possibility of future use of groundwater for domestic purposes will be evaluated based on groundwater quality in the overburden and the bedrock.

Pending the analysis of the analytical data, estimates of exposure point concentrations of the chemicals and radionuclides of concern will be determined. The estimates will derive from numerical relationships between the chemical properties and medium-specific chemical concentrations or simplified screening model estimates. Such determinations will involve evaluation of the environmental fate and transport processes operable for each chemical.

Exposure scenarios will be constructed to quantify hypothetical exposure levels to human receptors. Reasonable Maximum Exposure (RME) will be evaluated using standard parameters and assumptions of intake. These values will provide reasonable estimates of exposure and yet not underestimate exposure. All parameters and assumptions will be documented, where possible, by reference to the scientific literature.

Risk Characterization: Information from the toxicity assessment and the exposure assessment will be integrated in this step to determine the likelihood, nature and magnitude of adverse human health effects posed by off-site contamination. The risk characterization will include an evaluation of carcinogenic and noncarcinogenic human health risks. Regulatory criteria will form the basis for the evaluation of human health risks associated with exposure to chemicals and radiation at the levels estimated in the exposure assessments. Human health risks associated with exposure to both individual chemicals and

chemical mixtures will be evaluated, in addition to the risk resulting from the radiation dose equivalent received by individuals exposed to radioactive materials at the site.

Uncertainty Analysis: Due to the large number of assumptions that are required during the human health evaluation process, there is often a considerable amount of uncertainty associated with the risk estimates. A "central tendency" risk estimate will be calculated for only the pathways associated with the greatest risk using exposure assumptions associated with the 50th percentile (the 95% upper confidence limit (or maximum) concentration term will not change).

5.6.2 Ecological Assessment

To evaluate environmental impacts, published information concerning the toxicity of various chemical constituents to organisms will be considered in tandem with observations and inventories of biota made during the ecological evaluation. If warranted, concentrations of contamination in on-site contaminated matrices will be extrapolated to probable contaminant concentrations at or within the organism (i.e., extrapolation allowing for dilution, organism uptake, bioaccumulation). Technical guidance needed to determine the level of detail to characterize ecological risks will be consistent with federal and state guidance documents (USEPA, 1991a; 1989a; NYSDEC, 1991).

An Ecological Assessment (EA) will be performed to evaluate potential impacts of site-generated pollutants to organisms and their respective habitats, both on-site and in the vicinity of the site (i.e., Glen Cove Creek). Specific guidance provided in the USEPA guidance document will be employed in the implementation of the EA. The objectives of an EA are:

- Identify and characterize existing ecological resources/habitats and resource values (quality/quantity of the resources) potentially within or affected by pathways of site-generated pollutants.
- Identify biological receptors which may utilize affected habitats.
- Evaluate the potential acute, chronic or bioaccumulation affects resulting from exposure to site-generated pollutants.

- Identify if further quantitative sampling/testing of biological and non-biological media is necessary (i.e., in-situ toxicity testing, bioaccumulation studies, tissue analysis).
- Evaluate the ecological suitability/impacts of selected alternatives with respect to both short and long-term remedial successes.

Where possible, existing quantitative data on pollutant concentrations, population size, density, dominance and diversity will be utilized for the site characterization. Background ecological data for the site will be obtained from state and federal agencies, as well as from field observations. The tasks for the baseline EA are as follows:

Documentation of Existing Conditions:

- A. **Site Description** - data obtained from federal, state and local agencies will be utilized in conjunction with field observations to document and assess existing ecological conditions. Specific data include vegetation cover type, fish and wildlife assemblages, significant habitats and wildlife concentration areas, endangered/threatened species, surface waters and wetlands. Available mapping will be collected and analyzed for the purpose of identifying unique site characteristics and features as well as potential pathways of exposure. Maps include USGS, NWI mapping and aerial photography.
- B. **Resource Characterization** - the quality of existing habitats will be evaluated based upon field observations with state and local agencies and local academia. Key indicators such as disturbed or stressed vegetation, leachate seeps, or observed wildlife mortality are factored into this resource characterization.
- C. **Hazard Threshold Identification** - based upon field and available data, ARARs will be determined. This may include as appropriate: surface water, groundwater and soils standards and criteria developed for the protection and maintenance of aquatic and terrestrial biological resources. Levels of contaminants detected at the site during field sampling activities will be compared to available federal and state standards and criteria for the various media involved. Where standards and/or criteria are not available for a particular compound, toxicity data will be utilized in the comparison. Consideration will also be given to the unique fate and transport characteristics of the pollutants of concern with respect to persistence, solubility, and bioavailability.

Risk Analysis: Information from the sources discussed above will then be utilized to evaluate the potential risk to aquatic and terrestrial biota on-site and in the vicinity of the site (Glen Cove Creek). Of consideration are potential pathways of exposure and endpoints, such as surface water quality standards, ambient water quality criteria for protection of

aquatic life, bioconcentration factors and published toxicity and uptake data will be utilized to assemble risk estimates for the pollutants of concern. Future risk will also be assessed for the site with and without remediation.

5.7 TASK 107 - TREATABILITY STUDIES/PILOT TESTING

Existing site data do not suggest at this time that treatability studies will be required to allow full development and evaluation of treatment alternatives during the detailed analysis portion of the FS, as discussed in Section 3.6 of this Work Plan. As site data are collected, however, it may be determined that existing technologies may not be able to treat the particular contaminants, levels of contaminants and/or mixtures of contaminants in various media. A treatability study would be recommended under these circumstances.

To evaluate the need for a treatability study, validated chemical quality data from soil, sediment, surface water and groundwater samples will be compared to the USEPA Office of Research and Development - Treatability Study Database (ORD-TSD) after collection. If review of the ORD-TSD identifies the need for a treatability study, a proposal will be prepared and submitted to the USEPA. The proposal will utilize the treatability guidance document (USEPA, 1989d); and Chapter 5 of the RI/FS guidance document (USEPA, 1988a).

5.8 TASK 108 - REMEDIAL INVESTIGATION (RI) REPORT

A Draft Remedial Investigation (RI) Report will be prepared concurrently with Tasks 103, 104, 105 and 106 and submitted to the USEPA for review after the completion of Task 106. The report will follow the latest guidance documents (USEPA, 1988). The report will include discussion of the data from the previous sampling programs as well as the data and analyses performed as part of this RI. When the Draft RI report is completed, it will be submitted to the USEPA for review and comment. Following receipt of all USEPA written comments, the report will be revised and resubmitted to the USEPA. Revisions will be completed within four weeks. When the USEPA determines that the Draft RI Report is acceptable, it will be deemed the "Final RI Report".

5.9 TASK 109 - DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES

This task represents the first phase of the Feasibility Study (FS). Its purpose is to develop and select an appropriate range of remedial alternatives to be analyzed more fully in the second phase of the FS, the detailed analysis. The requirements of §300.430(e) of the National Contingency Plan (NCP) and pages 4-3 through 4-28 of the RI/FS guidance document (USEPA, 1988a) shall be adhered to for the development and screening of the remedial action alternatives. Since the development of alternatives is fully integrated with site characterization activities (Tasks 103 through 106), the following activities will proceed under this task:

- Review the preliminary remedial action objectives [medium-or operable unit-specific goals for protecting human health and the environment (contaminants of concern, exposure routes and receptors, acceptable contaminant levels or ranges for exposure routes)] identified in Sections 3.5.1 and 3.5.2;
- Review the preliminary general response actions (medium-specific actions that will satisfy the remedial action objectives), identified in Sections 3.5.1 and 3.5.2;
- Determine whether modifications (e.g., refine, develop, change) to the preliminary remedial action objectives and preliminary general response actions are necessary to conform with the data and information derived from Tasks 103 through 106;
- Delineate the remedial action objectives and general response actions based upon the latter reviews and determinations;
- Identify the volumes or areas of media to which the identified general response actions might be applied (taking into account the requirements for protectiveness);
- Identify and screen the remedial technologies and process options applicable to each general response action (evaluate the universe of potentially applicable technology types and process options with respect to technical implementability in order to eliminate options which cannot be effectively implemented at the site);
- Evaluate process options using the criteria of effectiveness, implementability, and cost in order to select a representative process for each technology type retained for consideration (technology processes considered implementable are evaluated in greater detail before selecting one process to represent each technology type; one process is selected, if possible, for each technology type, to simplify the development and evaluation of alternatives without limiting flexibility during remedial design);

- Assemble the selected representative technologies into alternatives representing a range of treatment and containment combinations, as appropriate (general response actions should be combined using different technology types and different media and/or areas of the site).

As described below for certain categories of response actions, various ranges of alternatives must be included (the no-action alternative shall be included in every response action category):

- Source control actions will include a range of alternatives in which the principal element is treatment that reduces the toxicity, mobility, or volume of the hazardous substances, pollutants, or as appropriate, this range shall include an alternative that removes or destroys hazardous substances, pollutants, or contaminants to the maximum extent feasible, eliminating or minimizing extent feasible, eliminating or minimizing, to the degree possible, the need for long-term management. Other alternatives will be developed which, at a minimum, treat the principal threats but vary in the degree of treatment and the quantities and characteristics of the treatment residuals and untreated waste that must be managed. One or more alternatives will be developed which provide little or no treatment, but provide protection of human health and the environment by preventing or controlling exposure to hazardous substances, pollutants, or contaminants, through engineering controls.
- Groundwater actions will include a limited number of alternatives that attain site-specific remediation levels within different restoration time periods utilizing one or more different technologies.

In addition, and to the extent sufficient information is available, the short and long term aspects of the following three criteria shall be used to screen the defined remedial alternatives:

- Effectiveness - the degree to which an alternative reduces toxicity, mobility, or volume through treatment, minimizes residual risks, and affords long term protection, complies with ARARs, minimizes short term impacts, and time to achieve protection;
- Implementability - the technical feasibility and availability of the technologies each alternative would employ and the administrative feasibility of implementing the alternative; and
- Cost - the costs of construction and any long term costs to operate and maintain the alternatives.

Information available at the time of screening will be used primarily to identify and distinguish any differences among the various alternatives and to evaluate each alternative with respect to its effectiveness, implementability, and cost. Alternatives with the most

favorable composite evaluation of all factors shall be retained for further consideration during the detailed analysis. However, alternatives selected for detailed analysis should, where practicable, preserve the range of treatment and containment technologies initially developed.

Innovative technologies are technologies which are fully developed but lack sufficient cost or performance data. If any innovative technologies are defined and are determined to offer: the potential for comparable or superior performance or implementability; fewer or lesser adverse impacts than other available approaches; or lower costs for similar levels of performance than demonstrated treatment technologies; then such innovative technologies shall be carried through the screening phase.

5.10 TASK 110 - DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

This task represents the second phase of the FS. Its purpose is to evaluate the alternatives carried through the screening phase of the FS in order to provide the basis for identifying a preferred alternative for remedial action. The detailed analysis will consist of the following components:

- Identification and further definition (details) of the alternatives selected from the screening phase (including details on volumes or areas of contaminated media to be addressed, the technologies to be used, and any performance requirements associated with the technologies);
- An assessment and a summary profile of each alternative against the nine evaluation criteria; and
- A comparative analysis among the alternatives to assess the relative performance of each alternative with respect to each evaluation criterion.

The performance of this task shall be conducted in conformance with the methodology identified in the RI/FS guidance document (USEPA, 1988a) and the conditions specified under 300.430(e) of the NCP (March 1990).

5.11 TASK 111 - FEASIBILITY STUDY (FS) REPORT

A Draft FS Report shall be prepared and written in accordance with the RI/FS guidance document (USEPA, 1988a) and the format specified on page 6-15 of that document. The

submission date of the draft FS Report shall be determined at the FS alternative screening meeting. Following receipt of USEPA comments, the report shall be revised and resubmitted to the USEPA within an estimated schedule of four weeks. A Draft FS Report does not become "Final" until the public comment period has ended and public comments on the report, if received, are incorporated.

Upon approval by the USEPA, the report shall be deemed "Final FS Report."

5.12 TASK 112 - POST RI/FS SUPPORT

This task includes efforts to prepare the public comment responsiveness summary, support the ROD, conduct any predesign activities and close out the work assignment. All activities occurring after the release of the FS to the public, other than reviewing/finalizing the FS itself, should be reported under this task. The following are typical activities:

- Preparing the predesign report
- Preparing the conceptual design
- Attending public meetings
- Writing and reviewing the responsiveness summary
- Supporting ROD preparation and briefings
- Reviewing and providing QC of the work effort
- Providing task management and QC

5.13 TASK 113 - ENFORCEMENT SUPPORT

This task includes efforts during the RI/FS associated with enforcement aspects of the project. Activities vary but are associated with efforts related to PRPs. The following are typical activities:

- Reviewing PRP documents
- Attending negotiation meetings

- Preparing briefing materials
- Assisting in the preparation of EDD
- Providing task management and QC

5.14 TASK 114 - MISCELLANEOUS SUPPORT

This task is used to report on work that is associated with the project but is outside the normal RI/FS scope of work. Activities will vary but will include the following:

- Specific support for coordination with and review of ATSDR activities and reports
- Support for the review of special state or local projects

6.0 SCHEDULE

The proposed schedule for the Li Tungsten RI/FS is provided in Figure 6-1.

7.0 PROJECT MANAGEMENT APPROACH

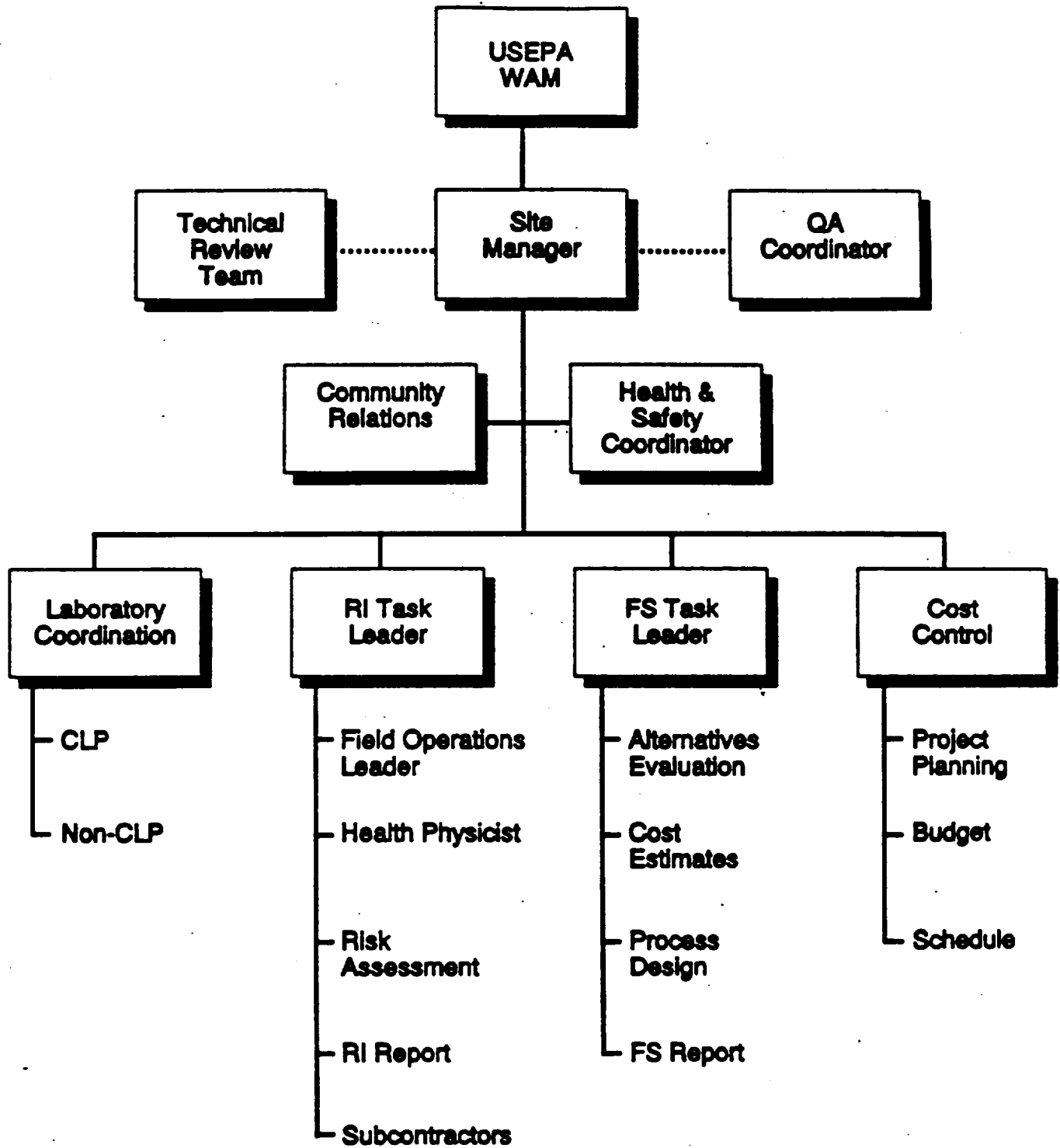
7.1 ORGANIZATION AND APPROACH

The Site Manager (SM) for the RI/FS will manage the day-to-day technical and financial aspects of the project and will interact directly with the USEPA Work Assignment Manager (WAM). The SM will manage all aspects of the project from work planning through completion of the RI/FS report and project close-out. The SM has primary responsibility for plan development and implementation of the RI/FS, including coordination among the RI and FS task leaders and support staff, acquisition of engineering or specialized technical support, and other aspects of the day-to-day activities associated with the project. The SM identifies staff requirements, directs and monitors site progress, assures implementation of quality control procedures and is responsible for performance within the established budget and schedule. A project organization chart along functional lines for the Li Tungsten RI/FS is presented in Figure 7-1.

The project team members are selected for their qualifications and experience with the technical issues to be addressed at the site. If unanticipated site problems or project needs are encountered that cannot be adequately handled by this team, technical experts from other offices will be used as necessary with USEPA's concurrence.

The Quality Assurance Coordinator is responsible for ensuring that appropriate QC procedures are implemented, including acquisition of field equipment and supplies, development of the Quality Assurance Project Plan (QAPjP), reviews of specific tasks, QC procedures and validation of laboratory data. The Quality Assurance Coordinator reports directly to the corporate QA Manager and is independent of the SM's reporting structure.

The RI Task Leader will work directly with the SM to develop the Field Operations Plan (FOP) and will be responsible for the implementation of the field investigation, interpretation and presentation of data acquired, the environmental and health risk assessment, and preparation of the RI report.



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The FS Task Leader will work closely with the RI Leader to ensure that the field investigation generates the proper type and quantity of data for use in the initial screening of remedial technologies/alternatives (Task 109), detailed evaluation of remedial alternatives (Task 110), and associated cost analysis. The FS Report (Task 111) will be developed by the FS technical group under the direction of the FS Task Leader.

The Field Operations Leader (FOL), reporting to the SM, is responsible for on-site management for all site operations, including the work performed by subcontractors, such as well drilling and surveying. The FOL will consult and decide on issues relating to sampling activities and changes to the field sampling program. The FOL will coordinate with the RI Task Leader.

The Regional Sample Coordinator will ensure compliance with the USEPA Regional Sample Control Center (RSCC) requirements for CLP services and analyses as described in the SAP. The sample coordinator will be responsible for assuring samples are properly collected, preserved, packaged, and shipped in accordance with USEPA guidelines.

7.2 COORDINATION WITH USEPA

The SM is responsible for coordinating the project with the WAM. Weekly telephone contact will be maintained to provide updates on project status. All coordination activities with the NYSDEC will be through the USEPA, although direct contact between the SM and NYSDEC may be maintained, if required and approved by the USEPA. A log of any direct communication with the NYSDEC will be maintained.

7.3 SCHEDULE CONTROL

As the project proceeds, the SM will monitor actual progress against the schedule outlined in this Work Plan, and deliverable due dates on a bi-weekly basis and update them, as necessary. The USEPA standard RI/FS task numbering system for the RI/FS effort is described in Section 5 of this Work Plan. Each of these tasks has been scheduled and will be tracked separately during the RI/FS work. The SM will inform the WAM of any known or anticipated change of project elements. If a delay occurs or is anticipated, the SM will develop and outline available methods to maintain the overall project schedule. Progress

meetings will be held, as needed, to evaluate project status, discuss current items of interest, and review major deliverables such as the FOP, Health and Safety Plan (HASP), and the RI and FS reports.

7.4 QUALITY ASSURANCE

The QAPjP will be in accordance with the Quality Assurance Program Plan and Quality Assurance Project Plan as approved by the USEPA.

Work on this assignment will be conducted in accordance with the procedures defined in the site-specific FOP which includes the QAPjP and the Field Sampling Plan (FSP). These documents will be prepared for USEPA review and approval after submittal and USEPA approval of this Work Plan. Field blanks, field replicates, trip blanks and samples for laboratory spiking and duplicates will be submitted to the laboratory as outlined in the FOP. The desired precision and accuracy of laboratory and field data will be documented in the FOP. Laboratory data will be validated in accordance with Region II data validation guidelines.

Deliverables will be reviewed by the quality control review team assigned to this project. The SM will coordinate these reviews and will promote frequent progress reviews during the project. The comments of the review team will be incorporated into the deliverables before review drafts are submitted to USEPA.

7.5 LABORATORIES

Samples collected for chemical analysis will be analyzed by CLP laboratories procured through the RSCC. Based on our knowledge of the Superfund process and the site, the project team assigned to work on the site will:

- Submit only the number of samples to CLP laboratories that are necessary to meet DQOs.
- Request analyses of only those compounds needed to meet the DQOs, tailoring analyses to site-specific conditions, as necessary.

- Schedule analyses with USEPA Region II and SMO through the RSCC well in advance of sampling trips as required for RAS and SAS.
- Maintain sample shipment schedules to promote an orderly progression of samples into the CLP laboratories.

The status of analyses to be performed by CLP laboratories will be monitored and potential delays noted through contact with the RSCC.

Samples collected for radiochemical analysis must be analyzed by a non-CLP laboratory. Data validation protocols for the radiochemical data will be the same as those approved by the USEPA for the U. S. Radium RI/FS project. These data validation protocols are presented in Appendix C.

7.6 COORDINATION WITH OTHER AGENCIES

RI activities at the site will require coordination among numerous federal, state, and local agencies and coordination with involved private organizations. Coordination activities with these agencies are as described below.

7.6.1 Federal Agencies

USEPA is responsible for overall direction and approval of all activities for the Li Tungsten site. USEPA may designate technical advisors and experts from academia or its technical support branches to assist on the site. Agency advisors could provide important sources of technical information and review, which the Contractor will use from work planning through final reporting.

Sources of technical information are such agencies as USEPA, U.S. Army Corps of Engineers (USACOE), Agency for Toxic Substances and Disease Registry (ATSDR), U. S. Geological Survey (USGS), USEPA Laboratories/Edison, U.S. Department of Interior, and National Oceanic and Atmospheric Administration (NOAA). These sources can be used for background information on the site and surrounding areas.

7.6.2 State Agencies

The state, through NYSDEC, may provide review, direction, and input for the RI/FS. USEPA's WAM will coordinate contacts with NYSDEC.

7.6.3 Local Agencies

Local agencies that may be involved include Nassau County, City of Glen Cove, and City of Glen Cove departments such as planning boards, zoning and building commissions, police, and fire department, and utilities (water and sewer). Contacts with these local agencies will be coordinated through USEPA.

7.6.4 Private Organizations

Private organizations requiring coordination during the RI/FS include PRPs, concerned residents in the area, and public interest groups such as environmental organizations and the press. Coordination with these interested parties will be through the USEPA.

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8.0 REFERENCES

- EBASCO, 1991. Final Remedial Investigation Report, Mattiace Petrochemical Site, Operable Unit One, Glen Cove, NY. Prepared for the USEPA under ARCS Contract No. 68-W8-0110, Work Assignment No. 006-2L2B, by Ebasco Services, Inc., Lyndhurst, NJ; 2 volumes.
- G&M, 1988. Hydrogeologic Investigation At the Li Tungsten Facility, Glen Cove, New York, April 1988. In: RTP, 1988. Li Tungsten Site Investigation Report. Prepared for Compton Realty Corporation, New York, NY, by RTP Environmental Associates, Inc., Westbury, NY, May 1988, 2 volumes.
- HART, 1990. Interim Remedial Actions Report. Prepared for the Glen Cove Development Company by Fred C. Hart Associates, Inc., New York, NY, April 4, 1990.
- HART, 1989. Radiological Survey Work Plan, Garvies Point, Glen Cove, NY, Site No. 130032. Prepared by Fred C. Hart Associates, Inc., New York, NY, June 1, 1989.
- ICRP, 1990. 1990 Recommendations of the International Commission on Radiological Protection, ICRP Publication 60.
- Isbister, J., 1966. Geology and hydrology of northeastern Nassau County, Long Island, New York. U. S. Geological Survey Water-Supply Paper 1825, 89 pp.
- Kilburn, C., 1972. Hydrogeology of the Town of North Hempstead, Nassau County, Long Island, New York. Long Island Water Resources Bulletin 12.
- Kilburn, C., R. K. Krulikas, 1987. Hydrogeology and Ground-Water Quality of the Northern Part of the Town of Oyster Bay, Nassau County, New York, in 1980. U. S. Geological Survey, Water Resources Investigations Report 85-4051
- Meyers, S., 1986. Guidance on Gamma Radiation Exposure in Residences. November 11, 1986 Memo to USEPA Region II.
- NDL, 1989. Preliminary Radiological Assessment of the Li Tungsten Facility, Glen Cove, NY. Prepared for Glen Cove Development Corporation, Baltimore, MD by The NDL Organization, Inc., Peekskill, NY. In: HART, 1990. Interim Remedial Actions Report. Prepared for the Glen Cove Development Company by Fred C. Hart Associates, Inc., New York, NY, April 4, 1990.
- NOAA, 1974. Department of Commerce, National Oceanic and Atmospheric Administration, LaGuardia Airport, New York, NY.
- NUS, 1991. Final Draft, Hazard Ranking System Documentation, Li Tungsten, Glen Cove, New York. Prepared under Technical Directive Document No. 02-9006-03, Contract No. 68-01-7346 for the Environmental Services Division, U. S. Environmental Protection Agency, Revision 2, February 15, 1991.

- NUS, 1990. Final Draft, Site Inspection Report, Li Tungsten, Glen Cove, NY, Rev No. 0. Prepared under Technical Directive Document No. 02-9003-01, Contract No. 68-01-7356 for the Environmental Services Division, U.S. Environmental Protection Agency, September 28, 1990; 5 volumes.
- NUS, 1989. Final Draft, Preliminary Assessment, Li Tungsten, Glen Cove, NY, Rev. No. 1. Prepared under Technical Directive Document No. 02-8907-28, Contract No. 68-01-7356 for the Environmental Services Division, U.S. Environmental Protection Agency, October 18, 1989; 1 volume.
- NYSDEC, 1991. Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites. Prepared by NYSDEC Division of Wildlife, Albany, NY.
- RTP, 1988. Li Tungsten Site Investigation Report. Prepared for Compton Realty Corporation, New York, NY. Prepared by RTP Environmental Associates, Inc., Westbury, NY, May 1988, 2 volumes.
- Smolensky, D. A., H. T. Buxton, and P. K. Shernoff, 1989. Hydrogeologic Framework of Long Island, New York. U. S. Geological Survey, Hydrologic Investigations Atlas, HA-709.
- Swarzenski, W. V., 1963. Hydrogeology of Northwestern Nassau and Northeastern Queens Counties, Long Island, New York. U. S. Geological Survey, Water Supply Paper 1657.
- U.S. Department of Commerce, 1990. 1990 Census of Population and Housing - Summary Tape File 1a. Bureau of the Census.
- USEPA, 1992a. A Citizen's Guide to Radon, 2nd Edition. U. S. Environmental Protection Agency and the U. S. Department of Health and Human Services.
- USEPA, 1992b. Update to: Region II CERCLA QA/QC Manual, Revision I, October 1989.
- USEPA, 1991a. Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual. Supplemental Guidance: Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03. Washington, DC: Office of Emergency and Remedial Response.
- USEPA, 1991b. USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review, Multi-media, Multi-concentration (OLM01.0) and Low Concentration Water (OLC01.0), December 1990, Revised June 1991.
- USEPA, 1990a. CLP Organics Data Review and Preliminary Review, SOP No. HW-2, Revision No. 7, March 1990.
- USEPA, 1990b. Evaluation of Metals Data for the CLP, SOP No. HW-4, Revision No. 10, February 1990.

- USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A, Interim Final. EPA/540/1-89/002, Office of Emergency and Remedial Response, Washington, DC.
- USEPA, 1989b. Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual, Interim Final. EPA/540/1-89/001, Office of Emergency and Remedial Response, Washington, DC.
- USEPA, 1989c. Generic Work Plan Guidance, Draft.
- USEPA, 1989d. Guide for Conducting Treatability Studies Under CERCLA (Interim Final). EPA/540/2-89/058, December 1989, 138 pages.
- USEPA, 1989e. CERCLA Compliance with Other Laws Manual: Part II. Clean Air Act and Other Environmental and State Requirements. EPA/540/G-89/009, August 1989, 176 pages.
- USEPA, 1989f. Region II QA/QC Manual, October 1989.
- USEPA, 1989g. Laboratory Data Validation, Functional Guidelines for Evaluating Inorganics Analysis, Revised October 1989.
- USEPA, 1988a. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final. EPA/540/G-89/004, OSWER Directive 9355.3-01, Office of Solid Waste, Washington, DC, October 1988.
- USEPA, 1988b. CERCLA Compliance with Other Laws Manual: Interim Final. EPA/540/G-89/006, August 1988.
- USEPA, 1988c. Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion. Federal Guidance Report No. 11, EPA/520/1-88/020.
- USEPA, 1988d. Technology Screening Guide for Treatment of CERCLA Soils and Sludges. EPA/540/G-88/___, September 1988.
- USEPA, 1988e. USEPA Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites. EPA/540/G-88/003, OSWER Directive 9283.1-2, December 1988.
- USEPA, 1987a. Data Quality Objectives: Development Guidance for Uncontrolled Hazardous Waste Site Remedial Response Activities. EPA/540/G-87/003, OSWER Directive 9355.0-7B, March 1987.
- USEPA, 1987b. Additional Interim Guidance for FY-87 Records of Decision. OSWER Directive 9355.0-21.
- USEPA, 1987c. Compendium of Superfund Field Operations Methods. EPA/540/P-87/001, OSWER Directive 9355.0-14, Office of Emergency and Remedial Response, Washington, DC, December 1987.

USEPA, 1986a. Interim Guidance of Superfund Selection of Remedy. OSWER Directive 9355.0-19.

USEPA, 1986b. Superfund Exposure Assessment Manual.

USEPA, 1986c. Test Methods for Evaluating Solid Waste (SW-846) - Revision 3.

USEPA, 1986d. Guidance of Gamma Radiation Exposure in Residences. Office of Radiation Programs memo from Sheldon Meyers to Paul Giardiana, Radiation Representative, Region II, November 19, 1986.

USGS, 1979. Topographic Map, Sea Cliff Quadrangle, Scale: 1:24,000, photorevised 1979.

USGS, 1946. Record of Wells in Nassau County, New York, Supplement No. 1. Prepared by the USGS in cooperation with the Water Power and Control Commission and the Nassau County Department of Public Works, Bulletin GW-10, Albany, NY.

9.0 GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ABBREVIATIONS AND ACRONYMS

ACGIH	American Conference of Governmental and Industrial Hygienists
ACM	Asbestos Containing Material
AEA	Atomic Energy Act of 1954
AGST	Above Ground Storage Tank
ALARA	As Low As Reasonably Achievable
AOC	Administrative Order on Consent
APT	Ammonium Paratungstate
ARARs	Applicable or Relevant and Appropriate Requirements
ARCS	Alternative Remedial Contracting Strategy
ASTM	American Society of Testing Materials
ATSDR	Agency for Toxic Substance and Disease Registry
BEIR	Committee on the Biological Effects of Ionizing Radiation
Bq	Becquerel
BNA	Base-Neutral/Acid Extractables
BOD	Biological Oxygen Demand
CAA	Clean Air Act
CDI	Chronic Daily Intakes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulation
Ci	Curie
CLP	Contract Laboratory Program
cm	Centimeter
CMA	Chemical Manufacturer's Association
CO	Contracting Officer (USEPA)
COD	Chemical Oxygen Demand
CPF	Carcinogenic Potency Factor
CRQL	Contract Required Quantification Limit
CRS	Cultural Resources Survey
DOE	Department of Energy

DOT	Department of Transportation
DQO	Data Quality Objectives
EA	Ecological Assessment
ECL	Environmental Conservation Law
EMS	Emergency Medical Service
ESD	Environmental Services Division (USEPA)
FAR	Federal Acquisition Regulation
FIT2	Field Investigation Team - USEPA Region II
FOL	Field Operations Leader
FOP	Field Operations Plan
FRC	Federal Radiation Council
FS	Feasibility Study
FSP	Field Sampling Plan
FUSRAP	Formerly Utilized Sites Remedial Action Program
GC	Gas Chromatograph
GCDC	Glen Cove Development Corporation
GM	Geiger Mueller
G&M	Geraghty & Miller, Inc.
Gr	Gray
HART	Fred C. Hart Associates, Inc.
HASP	Health and Safety Plan
HEA	Health Effects Assessments
HEAST	Health Effects Assessment Summary Tables
HRS	Hazardous Ranking System
HVAC	Heating, Ventilation, Air Conditioning
ICRP	International Commission on Radiological Protection
IDL	Instrument Detection Limit
IRA	Interim Remedial Action
IRIS	Integrated Risk Information System
LILCO	Long Island Lighting Company
LLRWPA	Low Level Radioactive Waste Policy Act

LNAPL	Light Non-Aqueous Phase Liquid
LSA	Low Specific Activity
MEKP	Methyl Ethyl Ketone Peroxide
MCLs	Maximum Contaminant Levels
MCLGs	Maximum Contaminant Level Goals
MeV	Mega-electron Volts
MMB	Methods Monitoring Branch
MPI	Malcolm Pirnie, Inc.
mrem	millirem
mR/h	milliRoentgen per hour
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NAPL	Non Aqueous Phase Liquid
NAS	National Academy of Sciences
NCDOH	Nassau County Department of Health
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
NDL	The NDL Organization, Inc.
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NORM	Naturally Occurring Radioactive Material
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NUS	Halliburton-NUS, Inc.
NWI	National Wetland Inventory
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
ORD-TSD	Office of Research and Development - Treatability Study Database

OSHA	Occupational Safety and Health Administration
OVA	Organic Vapor Analyzer
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
pCi/g	picoCurie per gram
pCi/L	picoCurie per Liter
PIC	Pressurized Ion Chamber
PLM	Polarizing Light Microscopy
POTW	Publicly-Owned Treatment Works
PRAP	Preferred Remedial Alternative Plan
PRP	Potentially Responsible Party(ies)
PVC	Polyvinyl chloride
QA	Quality Assurance
QAPjP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QF	Quality Factor
Ra	Radium
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
R	Roentgen
rem	rem
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
RMPP	Radon Measurement Proficiency Program
ROD	Record of Decision
RSCC	Regional Sample Control Center
RSFMP	Remote Samples Facilities Management Program
RTP	RTP Environmental Associates, Inc.
SARA	Superfund Amendments and Reauthorization Act of 1986
SAS	Special Analytical Services
SBE	Small Business Enterprise

SDBE	Small Disadvantaged Business Enterprise
SDWA	Safe Drinking Water Act
SFMP	Remote Surplus Facilities Management Program
SHPO	State Historic Preservation Officer
SM	Site Manager
SMO	Sample Management Office
SMP	Site Management Plan
SOP	Standard Operating Procedure(s)
SPT	Standard Penetration Test
SPDES	State Pollution Discharge Elimination System
Sv	Sievert
TAGM	Technical Administrative Guidance Memorandum
TAL	Target Analyte List
TBC	"To Be Considered" Material
TCL	Target Compound List
TCLP	Toxicity Characteristics Leaching Procedure
TDS	Total Dissolved Solids
TEM	Transmission Electron Microscopy
Th	Thorium
TLV	Threshold Limit Value
TOC	Total Organic Carbon
TOGS	Technical and Operations Guidance Series
TSS	Total Suspended Solids
TSCA	Toxic Substance Control Act
μg/Kg	microgram per Kilogram
μg/L	microgram per Liter
μR/h	microRoentgen per hour
U	Uranium
UMTRCA	Uranium Mill Tailing Radiation Control Act
USACOE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

VOCs Volatile Organic Compounds
WAM Work Assignment Manager
WCC Wah Chang Corporation
WCSRC Wah Chang Smelting and Refining Corporation
WET Wetlands Evaluation Technique
WL Working Level